



Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041 (18)
August 1978

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National Aeronautics and
Space Administration

Earth Resources
A Continuing Bibliography with Indexes

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EARTH RESOURCES

**A Continuing Bibliography
With Indexes
Issue 18**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between April 1, 1978 and June 30, 1978

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Branch

1978

National Aeronautics and Space Administration

Washington, DC

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Springfield, Virginia 22161, at the price code E05 (\$9.00 domestic; \$18.00 foreign).

INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 434 reports, articles, and other documents announced between April 1 and June 30, 1978 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in *STAR*, or *IAA*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the variation in citation appearance.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

- IAA* entries identified by accession number series A78-10,000 in ascending accession number order;

- STAR* entries identified by accession number series N78-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

- subject, personal author, corporate source, contract number and report/accession number.

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NOTE ON ORDERING DOCUMENTS: When ordering NASA publications (those followed by the * symbol), use the N accession number. NASA patent applications (only the specifications are offered) should be ordered by the US-Patent-Appl-SN number. Non-NASA publications (no asterisk) should be ordered by the AD, PB, or other *report* number shown on the last line of the citation, not by the N accession number. It is also advisable to cite the title and other bibliographic identification.

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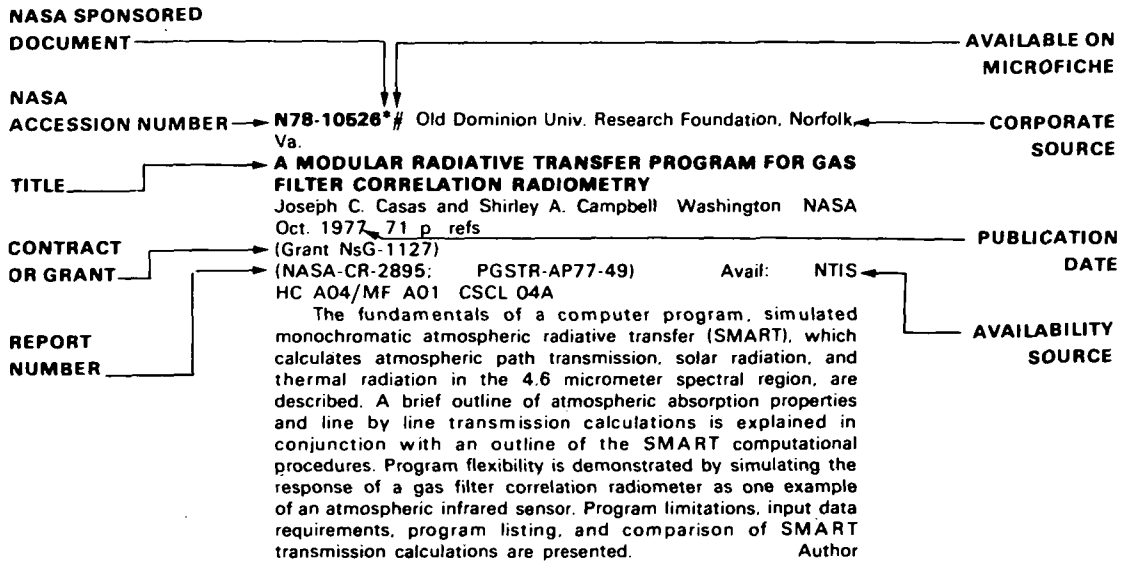
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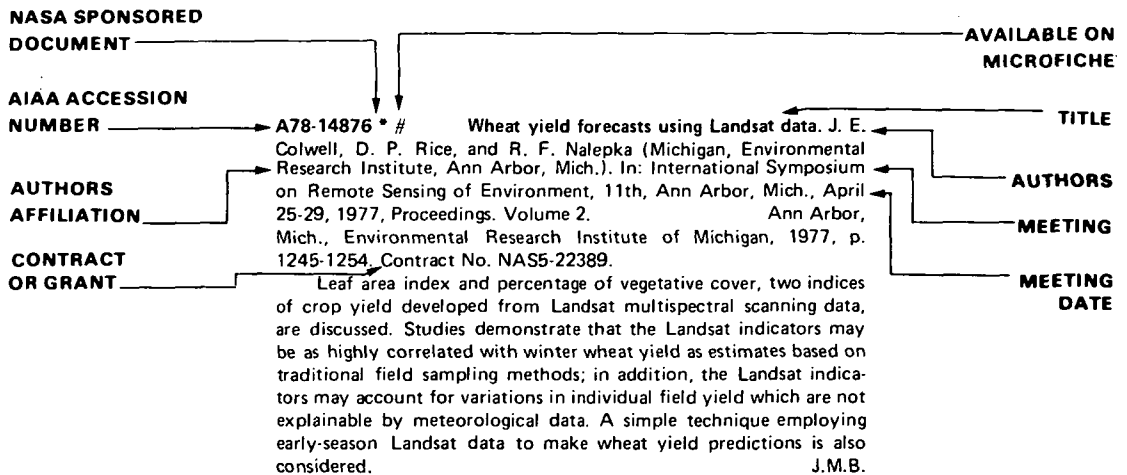
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EARTH RESOURCES

A Continuing Bibliography (Issue 18)

AUGUST 1978

01

AGRICULTURE AND FORESTRY

Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

A78-21342 * Remote sensing of crop type and maturity. W. Collins (NASA, Goddard Institute for Space Studies, New York, N.Y.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Jan. 1978, p. 43-55. 17 refs.

A red-shift in the chlorophyll absorption edge of heading wheat and grain sorghum is clearly visible in high-spectral-resolution measurements made from a low-flying aircraft over Imperial Valley, California. The position of the absorption edge shifts progressively toward the longer wavelengths during the crop growth cycle. The red-shift of 7 to 10 nm can be measured by using 10 nm-wide spectral bands, centered at 745 nm and 785 nm. These two bands, plus a band in the pigment absorption region at 670 nm, contain enough information to identify wheat and grain sorghum in the heading stage, to indicate the degree of heading, and to indicate canopy density during the heading stage. (Author)

A78-21345 * Crop water-stress assessment using an airborne thermal scanner. J. P. Millard (NASA, Ames Research Center, Moffett Field, Calif.), R. D. Jackson, R. J. Reginato, S. B. Idso (U.S. Department of Agriculture, Agricultural Research Service, Phoenix, Ariz.), and R. C. Goettelman (LFE Corp., Richmond, Calif.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Jan. 1978, p. 77-85. 12 refs.

An airborne thermal scanner was used to measure the temperature of a wheat crop canopy in Phoenix, Arizona. The results indicate that canopy temperatures acquired about an hour and a half past solar noon were well correlated with presunrise plant water tension, a parameter directly related to plant growth and development. Pseudo-colored thermal images reading directly in stress degree days, a unit indicative of crop irrigation needs and yield potential, were produced. The aircraft data showed significant within-field canopy temperature variability, indicating the superiority of the synoptic view provided by aircraft over localized ground measurements. The standard deviation between airborne and ground-acquired canopy temperatures was 2 C or less. (Author)

A78-21957 Measured spectral bidirectional reflection properties of four vegetated surfaces. K. T. Kriebel (München, Universität, Munich, West Germany). *Applied Optics*, vol. 17, Jan. 15, 1978, p. 253-259. 7 refs. Research sponsored by the Deutsche Forschungsgemeinschaft.

Spectral bidirectional reflectance values are presented at the 0.52-micron wavelength based on measured values of the radiation field of four vegetated surfaces: savannah, bog, pasture land, and coniferous forest, which cover a wide range of natural vegetated canopies. The results are given as examples of the full set of bidirectional reflectance values which consists of data at seven wavelengths between 0.43 and 2.20 microns for each of the four surfaces. The data may be applied for calculations of the radiative transfer in the atmosphere with realistic ground properties instead of isotropic albedo values. (Author)

A78-23079 Realistic land-use mapping (Realistische Landnutzungserhebungen). O. Kölbl (Eidgenössische Anstalt für das forstliche Versuchswesen, Birmensdorf, Switzerland). (*Deutsche Gesellschaft für Photogrammetrie und Fernerkundung, Internationales Symposium über Bildverarbeitung, Wechselwirkung zwischen Photogrammetrie und Fernerkundung, Graz, Austria, Oct. 3-5, 1977.*) *Bildmessung und Luftbildwesen*, vol. 46, Jan. 1, 1978, p. 4-11. 7 refs. In German.

Remote sensing methods are discussed for mapping land surfaces on a small scale. A comparison is made between multi-spectral satellite and aerial imaging, and aerial black/white and color photography tied into digital computer analysis. For very detailed maps of small areas, which accurately reflect land contours and long-term land use, the latter method is preferred. Difficulties involved in automatic multi-spectral imaging are pointed out, including: not enough specificity for small areas, and statistical error resulting from a mathematical interpretation of data. A purely visual interpretation of aerial photographs, with a computer assist, is considered unsurpassed for the kind of mapping discussed. D.M.W.

A78-25526 Discrete absorptions and emissions in crop spectra. V. R. Rao (Cauvery Bhavan, Bangalore, India), E. J. Brach (Department of Agriculture, Engineering Research Service, Ottawa, Canada), and A. R. Mack (Department of Agriculture, Soil Research Institute, Ottawa, Canada). *Applied Optics*, vol. 17, Feb. 15, 1978, p. 493-496. 6 refs.

The feasibility of performing luminescence measurements with a Fraunhofer line depth (FLD) imaging system in order to study crop maturity and crop variety identification is discussed. During the 1975 crop growing season, several crops (wheat, oats, barley, corn and soybean) were seeded on four different days. High resolution of these crops were taken from a low viewing angle at different stages of their growth. A mobile field spectroradiometer was used for these measurements in the spectral region of 350-1840 nm. The luminosity among the intense Fraunhofer lines of Fe, Ca, Mg, H, O and Na was studied from the spectral curves of the crops for discrimination of crops and their cultivars. B.J.

A78-25896 # Agricultural applications of radar. F. T. Ulaby and T. F. Bush (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: *Union Radio Scientifique Internationale, Open*

01 AGRICULTURE AND FORESTRY

Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 573-578. 5 refs.

An image simulation study was conducted to determine the optimum frequency/polarization combination for crop classification with a Shuttle-like imaging radar, with consideration of the effects of signal fading, system noise and field to field variations. The results indicate that over the 8-18 GHz band, 14.2 GHz and VV polarization is the most suitable combination for crop classification purposes. By gathering data every 10 days, it appears possible after four looks to correctly classify in excess of 90 percent. Crop monitoring was also examined: by observing the variations in the radar scattering coefficient with plant moisture, it has been possible to develop empirical models which quantitatively relate the scattering coefficient to plant moisture content. B.J.

A78-25897 # A radar backscatter model for vegetation targets. E. P. W. Attema (Delft, Technische Hogeschool, Delft, Netherlands) and F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 579-584. 8 refs.

A vegetation canopy was modeled as a water cloud whose droplets, randomly distributed, are held in place by the vegetative matter. A radar cross section per unit area was derived for a soil surface covered by a homogeneous vegetation layer; the cross section is a function of three parameters: (1) volumetric water content of the soil, (2) volumetric water content of the vegetation, and (3) plant height. The scattering properties of the equivalent cloud particles were obtained by regression analysis of measured scattering data for fields of alfalfa, corn, wheat and milo acquired over a four month period at several angles of incidence (0-70 deg) and frequencies for HH and VV polarizations. The model predicts angular as well as time responses of the radar cross section per unit area for each frequency and polarization for any given set of the three target parameters. B.J.

A78-26294 Simulator for remote sensing and its application to soil moisture measurements. H. Genda and H. Okayama (Chiba University, Chiba, Japan). *Applied Optics*, vol. 17, Mar. 1, 1978, p. 807-813. 8 refs.

It is of great significance to experiment with a simulator for remote sensing to confirm the properties and meaning of remote-sensed information and to forecast certain phenomena. This paper describes a simulator for remote sensing. The simulator, suitable for the measurement of soil moisture, consists of an optical source, a polarimeter, orbital guides for them, and a sample stage. SiC and MgO were used as soil models. The moisture in beach sand was also estimated. The degree of polarization increases with the moisture content and particle size of the sample. The field capacity point of each sample is determined by means of the polarimeter. (Author)

A78-26748 A NOAA-5 view of Alaskan smoke patterns. J. A. Ernst and M. Matson (NOAA, National Environmental Satellite Service, Washington, D.C.). *American Meteorological Society, Bulletin*, vol. 58, Oct. 1977, p. 1074-1076.

The recent large-scale lightning-caused Alaskan fires are discussed from the perspective of the NOAA-5 polar-orbiting satellite. Meteorologically significant information is obtained from interpretation of the satellite images of the smoke patterns resulting from the fires. (Author)

A78-27763 An evaluation of radar as a crop classifier. T. F. Bush and F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 15-36. 17 refs.

Results of an investigation to specify the parameters of a space-borne imaging radar for use in crop identification are discussed. The study relied on scattering data acquired with a ground-based radar which were degraded to simulate the performance of the proposed Space Shuttle Orbiter Imaging Radar. Data acquired from fields sown in corn, milo, soybeans, wheat and alfalfa were employed. The results of this study suggest that for best classification accuracy, a K-band (approximately 14 GHz), dual polarized system viewing fields at an off nadir angle in the 40 to 60 deg range should be employed. However it is emphasized that to attain classification accuracies exceeding 90%, multi-date acquisition is required. As best as can be determined, four target revisits at an interval of ten days is adequate for 90% accuracy. (Author)

A78-27768 Estimating forage crop production - A technique adaptable to remote sensing. R. J. Reginato, S. B. Idso, and R. D. Jackson (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 77-80. 7 refs.

The 'stress degree day' parameter, defined as the midafternoon crop canopy-air temperature differential, is employed to estimate the production of forage crops. Canopy temperature measurements are made with a downward-looking radiometer; air temperature measurements are procured with a portable aspirated psychrometer. In an experimental program the 'stress degree day' parameter is found to predict the alfalfa production from four sequential cuttings over a period from May to August. J.M.B.

A78-27769 Average variability of the radiation reflected by vegetated surfaces due to differing irradiations. K. T. Kriebel (München, Universität, Munich, West Germany). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 81-83. Research sponsored by the Deutsche Forschungsgemeinschaft.

A78-28380 Example of a study of soil salinity on IRC photographic plates (Exemple d'étude de la salinité des sols sur cliché IRC). A. Peyronel. In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1.

Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 67-73. In French.

A method for mapping the relative salinity of soils is developed, and the application of salinity mapping to the culture of rape in France is presented. Systematic equidensity filtering in the blue range provides a three-level classification for the rape cultures; the three-tier classification proves sufficient to distinguish between thriving, slightly affected and severely affected crops. For salinity mapping in a natural environment, a four-level separation based on blue and red filtering of the photographic plates is adopted. J.M.B.

A78-28381 An example of the use of infrared color emulsions for the study of the natural environment (Un exemple d'utilisation de l'émulsion infrarouge couleur pour l'étude du milieu naturel). J. Trautmann. In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1.

Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 75-79. In French.

A comparative study involving remote sensing of agricultural lands in Alsace, France with infrared color emulsions and infrared black and white emulsions demonstrates that the infrared color plates provide the more detailed information. In particular, the thermal infrared color emulsions yield data on local regions of high soil humidity; detection of property divisions formerly in existence also proves possible with the infrared color emulsions. J.M.B.

A78-28382 Three-color microdensitometry evaluation of IRC photographic plates for remote sensing of cochineal /*Matsucoccus Feytaudi* Duc./ assaults on the maritime pine forests of Southeast France (Evaluation par microdensitométrie trichrome de dichés IRC pour la télédétection d'attaque de cochenilles /*Matsucoccus Feytaudi* Duc./ dans les forêts de pins maritimes du Sud-Est de la France). Ch. Goillot (Institut National de la Recherche Agronomique, Versailles, France), Ch. Rossetti, J. Riom (Institut National de la Recherche Agronomique, Gazinet, Gironde, France), and J. P. Fabre (Institut National de la Recherche Agronomique, Avignon, France). In: *Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1.* Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 81-97. 5 refs. In French. Délégation Générale à la Recherche Scientifique et Technique Contract No. 71-7-2624.

A78-28388 The use of aerial data in the framework of the Agreste program focusing on rice (Utilisation des données aériennes dans le cadre du programme Agreste objectif riz). T. Le Toan (Centre d'Etude Spatiale des Rayonnements, Toulouse, France). In: *Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1.* Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 167-173. In French.

The Agreste program, a European venture aimed at identifying ricefields, studying the phenological stages of growth and estimating production, makes use of aerial reconnaissance data to calibrate Landsat imagery. Black and white photographs and multispectral scanning imagery are included in the aerial reconnaissance campaign; microdensitometry processing of digitized data is employed in analyzing the ricefields. Difficulties in distinguishing among wheat fields, prairie lands and rice plantations are discussed. J.M.B.

A78-28392 Airborne thermal mapping for the comparative study of forested and open zones /reapportioned/ in the western forest /Brittany, France/ (Etude par thermographie aéroportée de zones bocagères et ouvertes /remembrées/ comparativement dans la bocage de l'ouest /Bretagne - France/). Ch. C. Goillot, P. Valery, and P. Belluomo (Institut National de la Recherche Agronomique, Versailles, France). In: *Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1.*

Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 249-255. 5 refs. In French.

Thermal infrared data and multispectral observation of semi-forested regions in western France (Brittany) have provided information on the results of land reapportionment. In addition to quantifying the forest regions, the survey focuses on phenological states of vegetation and detectable evapotranspiration processes; an inventory of hedgerows, many of which have been eliminated in recent years, is also developed. J.M.B.

A78-29578 * Are two photographic infrared sensors required. C. J. Tucker (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Mar. 1978, p. 289-295. 12 refs. NSF Grant No. DEB-73-02027-A03.

The possible redundancy of photographic infrared (0.70-1.00 micron) sensors for monitoring vegetation and plant stresses was investigated using previously published data and the analysis of in situ narrow bandpass spectral data from experimental grass plots. Results of the analysis showed that a 0.76-0.90 micron photographic infrared sensor would combine excellent general vegetational utility with the ability to discriminate photographic infrared plateau-rounding stress conditions. A 0.76-0.90 micron sensor is therefore suggested for Landsat-D. (Author)

A78-29581 * Landsat spectral signatures - Studies with soil associations and vegetation. F. C. Westin and G. D. Lemme (South Dakota State University, Brookings, S. Dak.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Mar. 1978, p. 315-325. 13 refs. Grant No. NGL-42-003-007.

The effect of soils and vegetation upon Landsat spectral properties was investigated for a 12,950 hectare area. Six soil associations used for corn, small grains, and grass were analyzed for two dates during the 1974 growing season. Landsat scenes for April 19 and June 30 were studied to separate categories of agricultural land use and to assess the influence of soil association on the spectral signatures of vegetation and bare ground. The April 19 data were useful to separate cropland from grassland and to locate areas of open water. The June 30 data showed that soil associations could not consistently be separated within the data of a single vegetative type; however, the results showed that soils did influence all vegetative spectral reflectances to some degree. Because soils did influence vegetative spectral reflectance, a generalized training set containing data points from each of the six soil associations was used to separate four categories of agricultural land use in the 12,950 hectare test area. An accuracy of about 94% was obtained. (Author)

A78-29836 * The use of temporal data in Landsat crop surveys. L. R. Tinney (California, University, Santa Barbara, Calif.). In: *Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.* Falls Church, Va., American Society of Photogrammetry, 1977, p. 92-99. 12 refs. Grant No. NGL-05-010-404.

Multidate Landsat imagery has been applied for crop identification purposes in Kern County, California. The county's arid climate provides complete sets of cloud-free imagery throughout the crop-growing season. Both manual and digital techniques are used to study the value of the data, and a semiautomated video system is used to extract densitometric data from Landsat transparencies. It is noted that temporal variations in single-date classification performance and increases in multidate performance are caused by the physiological and phenological differences between types of crops. These differences may be used to introduce crop calendar data into satellite crop surveys. S.C.S.

A78-29837 * The Large Area Crop Inventory Experiment. R. B. MacDonald (NASA, Johnson Space Center, Earth Observations Div., Houston, Tex.). In: *Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.*

Falls Church, Va., American Society of Photogrammetry, 1977, p. 100-119. 10 refs.

Determination of wheat acreages in the central U.S., as well as the development and testing of yield models, is discussed in the framework of the Large Area Crop Inventory Experiment (LACIE). Particular attention is given to the goal of obtaining a 90% accuracy in yield forecasts in nine out of ten years. Current results of LACIE indicate that Landsat remote sensing data, in conjunction with information from agricultural meteorological surveys, can provide highly accurate early-season and at-harvest yield estimates in the principal wheat-growing regions of the world. J.M.B.

A78-29839 Inventory and mapping of flood inundation using interactive digital image analysis techniques. W. G. Rohde, C. A. Nelson (Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.), and J. V. Taranik (U.S. Geological Survey, Sioux Falls, S. Dak.). In: *Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.* Falls Church, Va., American Society of Photogrammetry, 1977, p. 131-143. 9 refs.

01 AGRICULTURE AND FORESTRY

Color infrared photographs and Landsat digital data provided a means of assessing the damage to agricultural land caused by the 1975 Red River Valley (North Dakota) flood. Problems related to the misclassification of recently plowed land and old residential areas (confused with inundated or partially inundated regions) were corrected; a maximum likelihood algorithm was employed to analyze the Landsat data. A multiphase sampling design provided a means of estimating the effect of flooding on crop production. J.M.B.

A78-30290 Vegetation modeled as a water cloud. E. P. W. Attema (Delft, Technische Hogeschool, Delft, Netherlands) and F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). *Radio Science*, vol. 13, Mar.-Apr. 1978, p. 357-364. 15 refs.

A volume scattering model for vegetation canopy is developed for radar remote sensing applications; the model treats the canopy as a water cloud whose droplets are held in place by the vegetation. Regression analyses of radar cross-section data in the 8-18 GHz range, together with ground-truth data for alfalfa, corn, milo and wheat, show that the model can yield correlation coefficients from 0.7 to 0.99, depending on frequency, polarization and crop type. Attenuation by the vegetation canopy, as well as the relative contributions of the soil and the vegetation to the observed radar cross-sections, may also be derived through use of the model. J.M.B.

A78-32392 * Ozone damage detection in cantaloupe plants. H. W. Gausman, D. E. Escobar, R. R. Rodriguez, C. E. Thomas, and R. L. Bowen (U.S. Department of Agriculture, Weslaco, Tex.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Apr. 1978, p. 481-485. 21 refs. Contract No. S-53876-AG.

Ozone causes up to 90 percent of air pollution injury to vegetation in the United States; excess ozone affects plant growth and development and can cause undetected decrease in yields. Laboratory and field reflectance measurements showed that ozone-damaged cantaloupe (*Cucumis melo* L.) leaves had lower water contents and higher reflectance than did nondamaged leaves. Cantaloupe plants which were lightly, severely, and very severely ozone-damaged were distinguishable from nondamaged plants by reflectance measurements in the 1.35- to 2.5 micron near-infrared water absorption waveband. Ozone-damaged leaf areas were detected photographically 16 h before the damage was visible. Sensors are available for use with aircraft and spacecraft that possibly could be used routinely to detect ozone-damaged crops. (Author)

A78-32393 * Distinguishing succulent plants from crop and woody plants. H. W. Gausman, D. E. Escobar, J. H. Everitt, A. J. Richardson, and R. R. Rodriguez (U.S. Department of Agriculture, Weslaco, Tex.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Apr. 1978, p. 487-491. 13 refs. Contract No. S-53876-AG.

We compared laboratory spectrophotometrically measured leaf reflectances of six succulents (peperomia, possum-grape, prickly pear, spiderwort, Texas tuberose, wolfberry) with those of four nonsucculents (ceno, honey mesquite, cotton, sugarcane) for plant species discrimination. Succulents (average leaf water content of 92.2 percent) could be distinguished from nonsucculents (average leaf water content of 71.2 percent) within the near-infrared water absorption waveband (1.35 to 2.5 microns). This was substantiated by field spectrophotometric reflectances of plant canopies. Sensor bands encompassing either the 1.6- or 2.2-wavelengths may be useful to distinguish succulent from nonsucculent plant species. (Author)

N78-16404 Texas Univ., Austin.
COMPUTER DETECTION OF CITRUS INFESTATIONS USING AERIAL COLOR INFRARED TRANSPARENCIES
Ph.D. Thesis

David Henry Williams 1977 173 p
Avail: Univ. Microfilms Order No. 77-23045

A computer algorithm is described which utilizes digitized color information from aerial color infrared transparencies to detect the presence of citrus mealybug (*Pseudococcus citri* Risso), brown soft scale (*Coccus hesperidum* L.), and Rio Grande gummosis in individual citrus trees. The color at each spatial point and color differences at adjacent points are used to locate the trees and to detect the infestations which are manifested by distinct color characteristics. The algorithm consists of four steps: a coordinate transformation to reduce the data base by one-third while simultaneously maximizing the class separation of the trees and background location of the individual trees, preprocessing for classification and classification of the individual trees according to health or infestation. Dissert. Abstr.

N78-16408* National Aeronautics and Space Administration, Washington, D. C.

APPLICATION OF LANDSAT IMAGES TO THE STUDY OF LEVEL SOILS FOR RECOGNIZING DRAINAGE AREAS
Thesis Paper

Moises Urena Espinoza Dec. 1977 221 p refs Transl. into ENGLISH from "Aplicacion de Imagenes Lansat en Estudios de Suelos Nivel de Reconocimiento Area Desaguadero" (Bolivia). Thesis. 1977 p 1-206 Original Doc. Prep. by Universidad Boliviana Mayor de "San Simon", Facultad de Ciencias Agricolas y Pecuarias "Martin Cardenas", Cochabamba (NASA-TM-75060) Avail: NTIS HC A10/MF A01 CSCL 08B

Photographic images from LANDSAT 1 were applied to the study of soil in Desaguadero, Bolivia, in order to locate areas with high agricultural and livestock potential. Photointerpretation techniques were emphasized and advantages of information obtained via multispectral satellite images in various bands and combinations were demonstrated. B.L.P.

N78-16409* National Aeronautics and Space Administration, Washington, D. C.

RESULTS OF ANALYSIS OF FLIGHT AND GROUND OBSERVATION MATERIALS FOR FIRST YEAR OF FIRST STAGE OF "PROGRAM OF EXPERIMENTAL RESEARCH TO DEVELOP METHODS FOR REMOTE SOUNDING OF SOILS AND VEGETATION ON ANALOGOUS SECTIONS OF THE UNITED STATES AND USSR FOR 1975-1980"

Jan. 1978 133 p Transl. into ENGLISH from Rezultaty Analiza Materialov Samoletnykh i Nazemnykh Nablyudeniye I-Ogo Goda Pervogo Etapa 'Programmy Eksperimental' Nykh Issledovaniy po Razrabotke Metodov Distantionnogo Zondirovaniya Pochv i Rastitelnosti na Uchastkakh analogakh v SShA i SSSR na 1975-1980 gg (Moscow). Rept. Academy of Sciences USSR. Jul. 1977 p 1-128 Transl. by SCITRAN, Santa Barbara, Calif. Original Doc. Prep. by Academy of Sciences USSR (Contract NASw-2791) (NASA-TM-75082) Avail: NTIS HC A07/MF A01 CSCL 08M

A joint U.S.S.R. and United States program to develop methods for remote sounding of soils and vegetation is reported. The program is being conducted on similar sections of land in the USSR and the United States. Details of the data obtained and the type of sensing equipments employed are provided in the appendices. Author

N78-17433* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

NATIONWIDE FORESTRY APPLICATIONS PROGRAM: TEN-ECOSYSTEM STUDY (TES) SITE 2, WARREN COUNTY, PENNSYLVANIA, SITE EVALUATION Final Report
C. A. Reeves, Principal Investigator Nov. 1977 62 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP

(Contract NAS9-15200)
(E78-10060: NASA-CR-151597; LEC-10565) Avail: NTIS HC A04/MF A01 CSCL 08F

The author has identified the following significant results. It was determined that hardwood in Warren County, Pennsylvania could best be inventoried in May. The acreage estimate was less than 3% different from Forest Service estimates.

N78-17434* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

NATIONWIDE FORESTRY APPLICATIONS PROGRAM. TEN-ECOSYSTEM STUDY (TES) SITE 1, GRAND COUNTY, COLORADO Final Report

R. D. Dillman, Principal Investigator Sep. 1977 54 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP

(Contract NAS9-15200)

(E78-10061; NASA-CR-151598; LEC-10691) Avail: NTIS HC A04/MF A01 CSCL 08F

N78-17442* Texas A&M Univ., College Station. Remote Sensing Center.

MICROWAVE REMOTE SENSING AND ITS APPLICATION TO SOIL MOISTURE DETECTION

Richard Wayne Newton, Principal Investigator Jan. 1977 531 p refs EREP

(Contract NAS9-13904)

(E78-10069; NASA-CR-151612; RSC-81) Avail: NTIS HC A23/MF A01 CSCL 08M

The author has identified the following significant results. Experimental measurements were utilized to demonstrate a procedure for estimating soil moisture, using a passive microwave sensor. The investigation showed that 1.4 GHz and 10.6 GHz can be used to estimate the average soil moisture within two depths; however, it appeared that a frequency less than 10.6 GHz would be preferable for the surface measurement. Average soil moisture within two depths would provide information on the slope of the soil moisture gradient near the surface. Measurements showed that a uniform surface roughness similar to flat tilled fields reduced the sensitivity of the microwave emission to soil moisture changes. Assuming that the surface roughness was known, the approximate soil moisture estimation accuracy at 1.4 GHz calculated for a 25% average soil moisture and an 80% degree of confidence, was +3% and -6% for a smooth bare surface, +4% and -5% for a medium rough surface, and +5.5% and -6% for a rough surface.

N78-18477 Kansas Univ., Lawrence.

ON THE FEASIBILITY OF MONITORING SOIL MOISTURE USING ACTIVE MICROWAVE REMOTE SENSING: AN EXPERIMENTAL EVALUATION Ph.D. Thesis

Percy P. Bativala 1977 123 p

Avail: Univ. Microfilms Order No. 77-28834

The radar backscattering coefficient of terrain, sigma, was considered as a function of the moisture content and surface roughness of the soil and of the vegetation cover. The effects of surface roughness and moisture content variations on sigma were evaluated, for the bare soil case, in terms of experimental data acquired over a wide range of surface roughness. The vegetation cover influence was considered as having a backscatter component of its own in addition to attenuating the soil backscatter component. The utility of remote sensing measurements for the estimation of soil moisture were briefly considered as well.

Dissert. Abstr.

N78-18478 Kansas Univ., Lawrence.

CROPLAND INVENTORIES USING AN ORBITAL IMAGING RADAR Ph.D. Thesis

Thomas Floyd Bush 1977 202 p

Avail: Univ. Microfilms Order No. 77-28844

Results of an evaluation of radar's capabilities to provide data suitable for crop species identification are presented. The study relied upon basic scattering data acquired with the Kansas University Remote Sensing Laboratory MAS 8-18, an angle and polarization agile radar spectrometer capable of precise and absolute measurements of the radar scattering coefficient. Scattering data were acquired from five field categories approximately once every six days during the growing season. A

data base was generated having angle, polarization, spectra and temporal dimensions. The data were first degraded by a random component to account for signal scintillation and then analyzed by means of an F-test procedure. Results suggest that a dual polarized radar operating at about 14 GHz at an off-nadir angle of around 50 deg is most suitable for crop classification purposes.

Dissert. Abstr.

N78-18486* Alaska Univ., Fairbanks. Geophysical Inst. **APPLICATION OF REMOTE SENSING DATA TO SURVEYS OF THE ALASKAN ENVIRONMENT Annual Report, 1 Jul. 1974 - 30 Jun. 1975**

J. M. Miller, Principal Investigator and A. E. Belon 30 Jun. 1975 224 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Grant NGL-02-001-092)

(E78-10077; NASA-CR-155731)

Avail: NTIS

HC A10/MF A01 CSCL 08F

N78-18489* Atomic Energy Commission, Dacca (Bangladesh). **INVESTIGATIONS USING DATA FROM LANDSAT 2 Quarterly Report, Oct. - Dec. 1977**

Anwar Hossain, Principal Investigator Jan. 1978 4 p refs Sponsored by NASA ERTS

(E78-10080; NASA-CR-155742)

Avail: NTIS

HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Ground truth data collected in coastal areas confirm the sedimentation base line at five fathom depth and less. Forestry ground truth at Supati in Sunderbasn was found to conform with stratifications in aerial photos and in some satellite imagery.

N78-18497* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ANALYSIS OF DATA SYSTEMS REQUIREMENTS FOR GLOBAL CROP PRODUCTION FORECASTING IN THE 1985 TIME FRAME

Sanford W. Downs, Paul A. Larsen, and Dietwald A. Gerstner Feb. 1978 48 p refs

(NASA-TP-1164; M-248) Avail: NTIS HC A03/MF A01 CSCL 02C

Data systems concepts that would be needed to implement the objective of the global crop production forecasting in an orderly transition from experimental to operational status in the 1985 time frame were examined. Information needs of users were converted into data system requirements, and the influence of these requirements on the formulation of a conceptual data system was analyzed. Any potential problem areas in meeting these data system requirements were identified in an iterative process.

Author

N78-19558 Texas A&M Univ., College Station.

CONSTRAINED NONLINEAR ESTIMATION APPLIED TO EARTH RESOURCES SATELLITE DATA Ph.D. Thesis

Henry Fred Ander 1977 78 p

Avail: Univ. Microfilms Order No. 77-32138

A variate transformation model was employed to estimate the percentage of a large land segment covered by a particular crop based on spectral intensity data. The procedure was based on a transformation of a mixed distribution of crop signatures into their known marginal distributions. The parameter estimates for the transformation were obtained simultaneously with the proportion of each crop type of interest on the land segment. Monte Carlo studies were made to investigate the properties of the estimates and the effectiveness of the solution methods applied.

Dissert. Abstr.

01 AGRICULTURE AND FORESTRY

N78-19559 Kansas State Univ., Manhattan.

EVALUATING GREAT PLAINS EVAPOTRANSPIRATION USING LANDSAT AND THERMAL IMAGERY Ph.D. Thesis
James Lester Heilman 1977 115 p

Avail: Univ. Microfilms Order No. 7800814

Crop temperature was measured remotely, and a form of the energy-balance equation that used crop temperature and the diffusion resistance to heat transport $r_{sub H}$ in the turbulent boundary layer was evaluated. Resistances were determined from wind speed and temperature profiles. Using aerial, thermal-scanner measurements of crop temperature evapotranspiration, estimates using the resistance model differed from lysimetric measurements by -0.40 to 0.17 ly/min, primarily due to errors in scanner measurements caused by atmospheric attenuation. Results indicated that thermal-scanner measurements of crop temperature in the resistance were useful for estimating ET on a regional basis if accurate estimates of $r_{sub H}$ were obtained and if scanner measurements were accurately extrapolated to ground level. Dissert. Abstr.

N78-19562* Bendix Corp., Ann Arbor, Mich.

LAND USE INVENTORY THROUGH MERGING OF LANDSAT (SATELLITE), AERIAL PHOTOGRAPHY AND MAP SOURCES

Robert H. Rogers, Larry E. Reed, William R. Enslin (Michigan State Univ., East Lansing), Kenneth E. Keifenheim (Michigan State Univ., East Lansing), Thomas H. Haga (GLS Region 5 Planning and Development Commission, Flint, Mich.), and Robert Karwowski (GLS Region 5 Planning and Development Commission, Flint Mich.) 2 Sep. 1977 16 p refs Presented at the Fall Meeting of the Am. Soc. of Photogrammetry and the Am. Congr. on Surveying and Mapping, Little Rock, Ark., 18-21 Oct. 1977 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(E78-10083; NASA-CR-155761; BSR-4292) Avail: NTIS HC A02/MF A01 CSCL 08B

N78-19567* Fort Lewis A&M Coll., Durango, Colo.

DEVELOPMENT OF A WINTER WHEAT ADJUSTABLE CROP CALENDAR MODEL Final Report

James R. Baker, Principal Investigator 14 Feb. 1978 77 p refs EREP
(Contract NAS9-15276)

(E78-10088; NASA-CR-151644) Avail: NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results. After parameter estimation, tests were conducted with variances from the fits, and on independent data. From these tests, it was generally concluded that exponential functions have little advantage over polynomials. Precipitation was not found to significantly affect the fits. The Robertson's triquadratic form, in general use for spring wheat, was found to show promise for winter wheat, but special techniques and care were required for its use. In most instances, equations with nonlinear effects were found to yield erratic results when utilized with daily environmental values as independent variables.

N78-19568* Fort Lewis A&M Coll., Durango, Colo.

DEVELOPMENT OF A WINTER WHEAT ADJUSTABLE CROP CALENDAR MODEL VOLUME 2: APPENDICES Final Report

James R. Baker, Principal Investigator 14 Feb. 1978 79 p EREP
(Contract NAS9-15276)

(E78-10089; NASA-CR-151643) Avail: NTIS HC A05/MF A01 CSCL 02C

N78-19576* Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

FORECASTS OF WINTER WHEAT YIELD AND PRODUCTION USING LANDSAT DATA Final Report, May 1975 - Oct. 1977

R. F. Nalepka, Principal Investigator, J. E. Colwell, and D. P. Rice Dec. 1977 160 p refs ERTS

(Contract NAS5-22389)

(E78-10098; NASA-CR-155794; ERIM-114800-38-F) Avail: NTIS HC A08/MF A01 CSCL 02C

N78-20593* Food and Agriculture Organization of the United Nations, Rome (Italy). Plant Production and Protection Div.

PILOT PROJECT ON THE APPLICATION OF REMOTE SENSING TECHNIQUES FOR IMPROVING DESERT LOCUST SURVEY AND CONTROL Final Report, Sep. 1976

Jelle U. Hielkema and J. A. Howard 1976 85 p refs Original contains color illustrations

(ISBN-92-5-100112-X) Avail: NTIS HC A05/MF A01

The outlines of an international cooperative program to use existing and future satellite systems to provide rapid and comprehensive information on the occurrence of potential desert locust breeding sites are outlined. General locust ecology is discussed and a brief account is given of the satellite remote sensing techniques applied in the project. The discussion of the results includes rainfall estimates by satellite versus ground station observations. ESA

N78-20594* Food and Agriculture Organization of the United Nations, Rome (Italy). Plant Production and Protection Div.

APPLICATION OF LANDSAT DATA IN DESERT LOCUST SURVEY AND CONTROL. DESERT LOCUST SATELLITE APPLICATION PROJECT, STAGE 2

Jelle U. Hielkema Sep. 1977 34 p refs Original contains color illustrations

(ISBN-92-5-100402-1) Avail: NTIS HC A03/MF A01

Results obtained during the pilot project on the use of remote sensing techniques for desert locust survey and control justified a more detailed investigation on the potential use of LANDSAT data. The results are presented and discussed of a program consisting of a study on the correlation between ground observed and satellite observed vegetal growth; the assessment of factors influencing the run-off component of the precipitation, and the assessment of some operational aspects on the use of LANDSAT data in a vegetation monitoring scheme. ESA

N78-21515* Kansas State Univ., Manhattan. Dept. of Statistics.

APPLICATION OF WHEAT YIELD MODEL TO UNITED STATES AND INDIA Final Report, 1 Mar. - 30 Nov. 1977

Arlin M. Feyerherm, Principal Investigator Dec. 1977 43 p EREP

(Contract NAS9-14533)

(E78-10109; NASA-CR-151656) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. The wheat yield model was applied to the major wheat-growing areas of the US and India. In the US Great Plains, estimates from the winter and spring wheat models agreed closely with USDA-SRS values in years with the lowest yields, but underestimated in years with the highest yields. Application to the Eastern Plains and Northwest indicated the importance of cultural factors, as well as meteorological ones in the model. It also demonstrated that the model could be used, in conjunction with USDA-SRRS estimates, to estimate yield losses due to factors not included in the model, particularly diseases and freezes. A fixed crop calendar for India was built from a limited amount of available plot data from that country. Application of the yield model gave measurable evidence that yield variation from state to state was due to different mixes of levels of meteorological and cultural factors.

N78-21517*# Kansas State Univ., Manhattan. Evapotranspiration Lab.
ESTIMATED WINTER WHEAT YIELD FROM CROP GROWTH PREDICTED BY LANDSAT Final Report, 1 Apr. - 31 Dec. 1977

Edward T. Kanemasu, Principal Investigator 31 Dec. 1977
 92 p refs EREP
 (Contract NAS9-14899)
 (E78-10112; NASA-CR-151655) Avail: NTIS
 HC A05/MF A01 CSCL 02C

N78-21519*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Oct. - 31 Dec. 1977

R. P. Mroczynski, Principal Investigator 20 Jan. 1978 33 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
 (Contract NAS9-15325)
 (E78-10114; NASA-CR-151653) Avail: NTIS
 HC A03/MF A01 CSCL 02F

N78-21522*# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
INVENTORY OF FOREST RESOURCES (INCLUDING WATER) BY MULTI-LEVEL SAMPLING Final Report, 7 Mar. 1975 - 15 Jul. 1977

Robert C. Aldrich, Robert W. Dana, and Edwin H. Roberts, Principal Investigators 15 Jul. 1977 183 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
 (NASA Order S-54053A)
 (E78-10118; NASA-CR-156083) Avail: NTIS
 HC A09/MF A01 CSCL 02F

The author has identified the following significant results. A stratified random sample using LANDSAT band 5 and 7 panchromatic prints resulted in estimates of water in counties with sampling errors less than + or - 9% (67% probability level). A forest inventory using a four band LANDSAT color composite resulted in estimates of forest area by counties that were within + or - 6.7% and + or - 3.7% respectively (67% probability level). Estimates of forest area for counties by computer assisted techniques were within + or - 21% of operational forest survey figures and for all counties the difference was only one percent. Correlations of airborne terrain reflectance measurements with LANDSAT radiance verified a linear atmospheric model with an additive (path radiance) term and multiplicative (transmittance) term. Coefficients of determination for 28 of the 32 modeling attempts, not adversely affected by rain shower occurring between the times of LANDSAT passage and aircraft overflights, exceeded 0.83.

N78-21524*# Environmental Research Inst. of Michigan, Ann Arbor.

USE OF LANDSAT DATA TO ASSESS WATERFOWL HABITAT QUALITY Final Report, Apr. 1975 - Jan. - 1978

John E. Colwell, David S. Gilmer, Principal Investigators (Northern Prairie Wildlife Research Center, Jamestown, N. Dak.), Edgar A. Work, Jr., Diana L. Rebel, and Norman E. G. Roller Jan. 1978 92 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
 (NASA Order S-54049A; Contract DI-14-16-008-2018)
 (E78-10120; NASA-CR-156087; ERIM-120000-15-F) Avail: NTIS HC A05/MF A01 CSCL 06C

The author has identified the following significant results. The capability of mapping ponds over a very large area was demonstrated, with multitemporal, multiframe LANDSAT imagery. A small double sample of aircraft data made it possible to adjust a LANDSAT large area census. Terrain classification was improved by using multitemporal LANDSAT data. Waterfowl production was estimated, using remotely determined pond data, in conjunction with FWS estimates of breeding population. Relative waterfowl habitat quality was characterized on a section by section basis.

N78-21531*# Forest Service, Washington, D. C.
OPERATIONAL PROGRAMS IN FOREST MANAGEMENT AND PRIORITY IN THE UTILIZATION OF REMOTE SENSING

Robert W. Douglass In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 27-31

Avail: NTIS HC A17/MF A01 CSCL 02F

A speech is given on operational remote sensing programs in forest management and the importance of remote sensing in forestry is emphasized. Forest service priorities in using remote sensing are outlined. L.S.

N78-21568*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

THE USE OF LANDSAT DIGITAL DATA AND COMPUTER-IMPLEMENTED TECHNIQUES FOR AN AGRICULTURAL APPLICATION

Armond T. Joyce (NASA. Earth Resources Lab., Slidell, La.) and R. H. Griffin, II (NASA. Earth Resources Lab., Slidell, La.) Jan. 1978 48 p refs Original contains color illustrations
 (NASA-RP-1016; JSC-12897; S-477) Avail: NTIS
 HC A03/MF A01 CSCL 02C

Agricultural applications procedures are described for use of LANDSAT digital data and other digitalized data (e.g., soils). The results of having followed these procedures are shown in production estimates for cotton and soybeans in Washington County, Mississippi. Examples of output products in both line printer and map formats are included, and a product adequacy assessment is made. Author

N78-21575*# National Aeronautics and Space Administration, Washington, D. C.

USE OF SATELLITE IMAGES IN THE EVALUATION OF FARMLANDS

Ana Estela Lozano H. Mar. 1978 9 p Transl. into ENGLISH of conf. paper from Secy. of Agriculture and Water Resources, Mex. Presented at UN/FAO Regional Training Seminar on the Application of Satellite Remote Sensing, La Paz, Bolivia, 1-9 Dec. 1977 p 1-5 Transl. by Sci. Transl. Serv., Santa Barbara, Calif. (Contract NASw-2791)

(NASA-TM-75088) Avail: NTIS HC A02/MF A01 CSCL 02C

Remote sensing techniques in the evaluation of farmland in Mexico are discussed. Electronic analysis techniques and photointerpretation techniques are analyzed. Characteristics of the basic crops in Mexico as related to remote sensing are described. Author

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ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

A78-21002 **The atmospheric distribution of nitrous oxide.** D. Pierotti and R. A. Rasmussen (Oregon Graduate Center, Beaverton, Ore.). (*American Geophysical Union and American Meteorological Society, Non Urban Troposphere Composition Symposium, Hollywood, Fla., Nov. 10-12, 1976.*) *Journal of Geophysical Research*, vol. 82, Dec. 20, 1977, p. 5823-5832. 35 refs.

There is some disagreement among researchers about the degree to which nitrous oxide varies at the surface, both on land and over the ocean. Measured variations in the surface concentration of N₂O range from 10% to less than 0.5%, implying atmospheric lifetimes from 1.4 years to greater than 28 years, respectively. Recent extensive measurements by the authors and co-workers indicate extremely little variation of nitrous oxide in the troposphere, with a concentration of approximately 330 ppb vol/vol. Continuous measurements made over a 3-month period showed a variation of less than 1%. Samples collected from 80 deg N to 90 deg S latitude showed no significant variation. Measurements in the troposphere and lower stratosphere showed a constant level of N₂O from the ground to the tropopause and then a gradual decrease in the lower stratosphere. The only large-scale variation found for nitrous oxide in the troposphere appears to be associated with the northeast trade winds system and may originate in North Africa. (Author)

A78-21795 # **Measurement of dispersion with a fast response aerosol detector.** R. B. Husar, E. S. Macias (Washington University, St. Louis, Mo.), and W. P. Dannevik (Environmental Quality Research, Inc., Clayton, Mo.). In: *Symposium on Atmospheric Turbulence, Diffusion, and Air Quality*, 3rd, Raleigh, N.C., October 19-22, 1976, Preprints. Boston, Mass., American Meteorological Society, 1977, p. 293-298. U.S. Environmental Protection Agency Grant No. R-803896.

Characteristics and applications of a detector for the sensing of rapidly changing concentrations of submicron aerosols are discussed. The fast-response device relies on the principle of diffusion charging and subsequent detection of charged aerosols. Field tests involving simultaneous automobile exhaust monitoring by a CO detector, a nephelometer and the aerosol detector are reported. In addition to temporal resolution of highly variable roadside aerosol emissions, the aerosol charge detector provides determination of the frequency spectrum of fluctuating aerosol concentrations. J.M.B.

A78-21806 # **Aircraft measurements of the Chicago urban plume at 100 km downwind.** W. A. Lyons and E. M. Rubin (KSTP Weather Services, Minneapolis, Minn.). In: *Symposium on Atmospheric Turbulence, Diffusion, and Air Quality*, 3rd, Raleigh, N.C., October 19-22, 1976, Preprints. Boston, Mass., American Meteorological Society, 1977, p. 358-365. 10 refs. Research supported by the Wisconsin Electric Power Co.; U.S. Environmental Protection Agency Grant No. R-800873.

An example is presented of a measurement of the pollutant plume from a large metropolitan area at distances sufficiently far enough downwind to label it as a mesoscale transport event. On June 28, 1974, the well-defined urban plume from the Chicago metropolitan area was observed as it drifted northwards across the Wisconsin border. It appears that pollutants accumulate over the industrialized areas of southern Chicago and northern Indiana and

then stream northwestward in a cohesive mass. In an aerial photograph obtained on April 18, 1967, the plume appears to be routed around the southwestern shoreline of Lake Michigan by a developing lake mesohigh and cold dome which effectively produces a weak convergence zone some 10-30 km inland during the daytime hours. G.R.

A78-21964 **High sensitivity pollution detection employing tunable diode lasers.** J. Reid, J. Shewchun, B. K. Garside, and E. A. Ballik (McMaster University, Hamilton, Ontario, Canada). *Applied Optics*, vol. 17, Jan. 15, 1978, p. 300-307. 22 refs. Research supported by Environment Canada and Ontario Ministry of the Environment.

A laser absorption spectrometer is described which employs a wavelength-tunable Pb(1-x)Sn(x)Se diode in conjunction with a multipass White cell and which is capable of measuring SO₂ concentrations in the low ppb range. The modulation techniques used in signal detection which make it possible to measure absorption coefficients as low as 0.0000001 per m are described. In addition, calibration of the instrumentation using small sample cells is described, and the question of interference from unwanted molecular species is discussed. The instrumentation allows the measurement, basically at the same time, of a large number of other atmospheric gases which are of significance in pollution studies. For example, the present diode operates over 1050-1150 per cm and can measure SO₂, O₃, N₂O, CO₂, H₂O, NH₃, and PAN. The addition of a second diode to the system will allow most gases of any atmospheric importance to be monitored. In general, these gases have much stronger IR absorption bands than SO₂ and hence can be detected at concentrations much less than 1 ppb. (Author)

A78-22863 # **Methods of measurement for the determination of gaseous air pollutants (Messmethoden zur Bestimmung gasförmiger Luftverunreinigungen).** G. Herrmann (Meteorologisches Observatorium, Wahnndorf, East Germany). *Zeitschrift für Meteorologie*, vol. 27, no. 6, 1977, p. 341-350. 25 refs. In German.

Effective and efficient approaches for preventing a pollution of the air must be based on reliable data regarding the type, the amount, and the distribution of the pollutants. The employment of appropriate analysis techniques is needed for obtaining the required data. A description is presented regarding some of the possibilities and problems concerning the measurement of gaseous pollutants. The planning of sampling procedures and techniques as a vital first step in the measurement program is considered. Statistical approaches are to be used to determine the most efficient form for the sampling program with regard to local and temporal characteristics. Selected analytical procedures for the determination of gaseous air pollutants are discussed, taking into account the colorimetric analysis of a trace component concentrated in an absorbing liquid, a personal monitoring device for gaseous contaminants, analyzers based on electrolytic conductivity, and polarographic-coulometric analyzers for measuring low concentrations of sulfur dioxide. Trends leading to the development of an automatic trace-gas analysis procedure are also considered. G.R.

A78-23038 **Granulometric spectrum of aerosol particles in slightly-polluted seaside atmosphere.** A. Renoux, G. Tymen, J.-F. Butor (Brest, Université, Brest, France), and G. Madelaine (Commissariat à l'Energie Atomique, Centre d'Etudes Nucléaires de Fontenay-aux-Roses, Fontenay-aux-Roses, Hauts-de-Seine, France). *Atmospheric Environment*, vol. 11, no. 12, 1977, p. 1127-1132. 14 refs.

A78-23051 # **Detection of air pollution from Landsat 1.** P. Brimblecombe and T. D. Davies (East Anglia, University, Norwich, England). *Weather*, vol. 33, Jan. 1978, p. 18-27.

Visual interpretation of multi-spectral imagery from the Landsat 1 satellite is applied to the study of air pollution over north-east England. Attention is given to the near-infrared spectra and its effectiveness in mapping plumes of industrial pollutants. Also discussed is the effect of normal weather patterns on the flow of air pollution in the area. D.M.W.

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A78-23117 Absorption coefficients of various pollutant gases at CO₂ laser wavelengths; application to the remote sensing of those pollutants. A. Mayer (Bremen, Universität, Bremen, West Germany), J. Comera, H. Charpentier, and C. Jaussaud (Commissariat à l'Energie Atomique, Centre d'Études Nucléaires de Grenoble, Grenoble, France). *Applied Optics*, vol. 17, Feb. 1, 1978, p. 391-393. 6 refs. ERDA-supported research.

A two-wavelength CO₂ laser designed for atmospheric pollution measurements has been used for determining the absorption coefficients of thirteen gas pollutants at CO₂ laser lines between 9.2 microns and 10.8 microns. All measurements were done with the pollutant at a low pressure in the presence of 1 atm of air. Sensitivities of about 5 ppb for a 1-km path have been obtained for ethylene. (Author)

A78-24309 Pinpointing airborne pollutants. L. S. Birks (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Environmental Science and Technology*, vol. 12, Feb. 1978, p. 150-153. 5 refs.

X-ray spectroscopy is well suited for air pollution analysis because of its accuracy in detecting very small (less than one microgram) particles. A description of the basic principles of this form of measurement is presented, together with a discussion of the advanced hardware which makes X-ray spectroscopy easy to use. In short, particles of any element can be excited by electromagnetic radiation and made to emit wavelengths having a characteristic line, or signature. X-ray radiation, because its own wavelengths are small, is sensitive to the small concentrations of pollutants usually found in laboratory air samples. Using the new equipment described in the article, an automatic analysis can be made of several characteristic element emission signatures at once. D.M.W.

A78-24382 A method for remote detection of oil spills using laser-excited Raman backscattering and backscattered fluorescence. T. Sato, Y. Suzuki, H. Kashiwagi (Ministry of International Trade and Industry, Electrotechnical Laboratory, Tokyo, Japan), M. Nanjo, and Y. Kakui (Ministry of International Trade and Industry, Electrotechnical Laboratory, Amagasaki, Japan). *IEEE Journal of Oceanic Engineering*, vol. OE-3, Jan. 1978, p. 1-4. 9 refs.

A laser method for the remote detection of oil present as a pollutant in the sea water using Raman backscattering and backscattered fluorescence is discussed. The scattering spectra of oils obtained by using a laser Raman spectrometer that employs a CW Ar laser are described. The backscattering spectra of oils obtained by a laser radar technique in the laboratory and the field are also described. Furthermore, theoretical performance of a laser radar with a CW laser or a pulsed laser for the detection of Raman backscattering of kerosene is discussed. (Author)

A78-24893 * # Description and review of global measurements of atmospheric species from GASP. D. J. Gauntner, J. D. Holdeman, D. Briehl, and F. M. Humenik (NASA, Lewis Research Center, Cleveland, Ohio). *ASTM, AMS, APCA, EPA, International Ozone Institute, NBS, and NOAA, Conference on Air Quality Meteorology and Atmospheric Ozone, Boulder, Colo., July 31-Aug. 6, 1977, Paper. 24 p.* 9 refs.

A large volume of atmospheric constituent data is being collected in the global airplanes by specially equipped B-747 aircraft. This NASA program also obtains data from the similarly equipped NASA CV-990 aircraft during dedicated flights such as a recent near pole-to-pole latitude survey mission. Aerosol composition data are also collected with a NASA F-106 aircraft. Present measurements include ozone, carbon monoxide, water vapor, aerosol and condensation nuclei number densities, sulphates, nitrates, and the chlorofluoromethanes. Meteorological and flight parameters are also recorded for use in data analysis. The present aircraft operations obtain data between 6 and 13.5 km from 65 deg N between Europe and the North Pacific, and from 23 deg S over South America and 42 deg S over New Zealand. Typical constituent data from the aircraft operations during the first one and a half years are presented. Instrumentation is discussed. (Author)

A78-25385 Remote sensing of aircraft wake vortex movement in the airport environment. B. T. Delaney (Exxon Research and Engineering Co., Mountainville, N.Y.), R. V. Noonkester (U.S. Naval Electronics Laboratory Center, San Diego, Calif.), and J. O. Ledbetter (Texas, University, Austin, Tex.). *Air Pollution Control Association, Annual Meeting, 70th, Toronto, Canada, June 20-24, 1977, Paper 77-41.4.* 16 p. 16 refs.

The use of FM-CW radar to track aircraft wake vortices at airports is discussed; remote tracking of vortices may aid in studying ground level pollution dispersion and the effects of vortex trails on encountering aircraft. Results are reported for a month-long test of a FM-CW radar system placed at the edge of a runway at Lindbergh Field, San Diego. V-echoes detected by the FM-CW radar appear to reflect the water and/or exhaust products trapped in the descending vortex trails of aircraft departing from the runway. Thus FM-CW radar detection seems a possible alternative to vortex sensing systems based on acoustic energy, anemometers, or laser backscatter. J.M.B.

A78-25395 Comparison of observed and calculated concentrations in the vicinity of two large point sources on Long Island, New York. J. C. Pace, Jr., F. W. Lipfert (Long Island Lighting Co., Hicksville, N.Y.), and T. F. Lavery (Environmental Research and Technology, Inc., Concord, Mass.). *Air Pollution Control Association, Annual Meeting, 70th, Toronto, Canada, June 20-24, 1977, Paper 77-29.3.* 15 p. 5 refs.

The SO₂ impacts of two electric generating plants, as assessed by a real-time SO₂ and meteorological monitoring network, were compared with modeling predictions that involved simulation of atmospheric turbulence through use of various diffusion coefficients. The diffusion coefficients included the ASME, Briggs and Pasquill-Gifford values. None of the coefficients adequately modeled the SO₂ impact, and significant modeling overprediction was the rule. J.M.B.

A78-25398 Consideration of background concentration in air quality analyses. C. Prasad (Virginia State Air Pollution Control Board, Richmond, Va.). *Air Pollution Control Association, Annual Meeting, 70th, Toronto, Canada, June 20-24, 1977, Paper 77-8.5.* 15 p. 16 refs.

The influence of background concentrations of pollutants on air quality analyses is discussed; particular attention is given to the role of background concentrations in the Air Quality Display Model and the Climatological Dispersion Model, recommended by the Environmental Protection Agency for the analysis of SO₂ and Total Suspended Particulates (TSP). Estimates have suggested that the background value of TSP may equal 30 to 40 micrograms/cu m, a significant portion of the secondary annual standard. Thus the need to include background concentration values in regression analyses and air quality simulation model calibration cannot be ignored. J.M.B.

A78-25534 * Analysis of differential absorption lidar from the Space Shuttle. E. E. Remsburg (NASA, Langley Research Center, Atmospheric Environmental Sciences Div., Hampton, Va.) and L. L. Gordley (Systems and Applied Sciences Corp., Hampton, Va.). *Applied Optics*, vol. 17, Feb. 15, 1978, p. 624-630. 10 refs.

A parametric analysis of the Shuttle-borne differential absorption lidar concept for the measurement of atmospheric trace constituent profiles in the nadir viewing mode is presented. The criterion of an optimum constituent optical depth is developed and applied to generate estimates of range resolved measurement errors. These errors emphasize the fundamental limitations for establishing the feasibility of range-resolved differential absorption lidar measurements from Shuttle. With current lidar system technology, atmospheric backscatter density profiles may be adequately determined up to about 60-km altitude at the doubled-ruby wavelength, 3472 Å, for a 1-J/pulse laser and a 1-sq m receiver. Potential range-resolved measurements of stratospheric and mesospheric trace constituents by

differential absorption from Shuttle altitudes are limited to H₂O, CH₄, N₂O, O₃, and CO, species which can be more easily measured by passive limb viewing techniques. Range-resolved water vapor data for the lower troposphere may be obtained with accuracies which would be competitive with those from passive sensors. (Author)

A78-25894 # A general matched filter approach to the remote probing problem. D. T. Gjessing (Forsvarets Forskningsinstitut, Kjeller, Norway). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 563-566.

A method of optimal sensitivity for the remote detection and recognition of an object or chemical agent is proposed. It is assumed that all the pertinent data are known. These target fingerprints are typically: the shape, size and texture of the object; the chemical composition of the surface; the chemical composition of gases and possible pollutants which the target may emit or leave behind. As examples, consideration is given to the matched optimum detection and identification of a chemical agent (e.g., sulfate deposited on vegetation) and the optimum detection and identification on the basis of target geometry. B.J.

A78-26148 Pollution evaluation: The quantitative aspects. W. F. Pickering (Newcastle University, Newcastle, Australia). New York, Marcel Dekker, Inc. (Environmental Science and Technology Series, Volume 2), 1977. 207 p. 34 refs. \$16.50.

The book deals with the quantitative evaluation of atmospheric pollution, with special attention given to: (1) principles of gravimetric, titrimetric, and absorption methods; (2) principles of emission spectroscopy, gas chromatography, mass spectrometry, and neutron activation analysis; and (3) principles of preconcentration, masking, and method selection. Other topics of interest include significance of sampling and statistics; monitoring of water; and pollutant determination in soil, plants, and food. The procedures discussed are illustrative rather than representing the approach of any particular environmental control agency. S.D.

A78-26296 Comparison of measured 3.8-micron scattering from naturally occurring aerosols with that predicted by measured particle size statistics. P. M. Livingston (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Applied Optics*, vol. 17, Mar. 1, 1978, p. 818-826. 6 refs.

Recent field measurements of scattered 3.8-micron laser radiation from naturally occurring aerosols were made during a 4-week period in coastal Southern California. Simultaneously, aerosol distribution measurements were made, which, in conjunction with Mie scattering theory, gave estimates of the volume scattering coefficient at the various angles. A comparison shows that (1) calculated volume scattering coefficients generally decrease more rapidly in angle than measurements indicate; (2) on the average, the calculation gives volume backscattering coefficients that are a factor of 2 larger than measured but underpredicts forward scattering by 33%. A second unrelated observation of interest is that volume scattering coefficients in the visible showed 65% correlation with 3.8-micron backscatter (177 degree) coefficients. (Author)

A78-27759 Identification of C₃-C₁₀ aliphatic dicarboxylic acids in airborne particulate matter. D. Grosjean, K. Van Cauwenberghe, J. P. Schmid, P. E. Kelley, and J. N. Pitts, Jr. (California University, Riverside, Calif.). *Environmental Science and Technology*, vol. 12, Mar. 1978, p. 313-317. 25 refs. NSF Grant No. ENV-73-02904-A04.

Airborne particulate samples collected during photochemical smog episodes were subjected to solvent extraction and fractionation, and the derivatized acid fractions were analyzed by combined gas chromatography-mass spectrometry using capillary columns and methane chemical ionization. Fifteen aliphatic dicarboxylic acids

ranging from malonic acid (C₃) to sebacic acid (C₁₀) were identified, nine of which (including all seven branched-chain acids) are reported for the first time. Possible hydrocarbon precursors of these acids in urban photochemical smog are discussed. (Author)

A78-28400 Supervised classification of the Entressen region (Classification supervisée de la zone d'Entressen). G. Saint (Centre National d'Etudes Spatiales, Toulouse, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 421-443. In French.

A supervised classification system, for the processing and interpretation of remote sensing data, is applied to the Entressen region near the Rhone estuary. The data are associated with natural and artificial prairies, wheat fields, and forest areas. S.C.S.

A78-28401 A multispectral remote sensing study of vegetation - An assessment of airport regions made from 1972 to 1975 in the Montpellier area (Etude de la végétation par télédétection multispectrale bilan des campagnes aéroportées réalisées de 1972 à 1975 dans le Montpelliérain). R. Lacaze (Centre d'Etudes Phytosociologiques et Ecologiques Louis Emberger, Montpellier, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 445-455. 12 refs. In French.

A78-29775 Methods for superimposing Landsat photographs for multitemporal land-use mapping (Methoden zur Überlagerung von Landsat-Bildern für multitemporale Landnutzungs-kartierungen). J. Lichtenegger (Zürich, Universität, Zürich, Switzerland), K. Seidel, and O. Kübler (Eidgenössische Technische Hochschule, Zurich, Switzerland). *Bildmessung und Luftbildwesen*, vol. 46, Mar. 1, 1978, p. 53-61. 5 refs. In German.

The superimposition, by means of affine transformations, of Landsat photographs obtained on different days is considered, and three methods of multitemporal interpretation of these photographs are compared. The difference-image method involves the superimposition of two transparent highly enlarged sections (one a negative, the other a positive) and visual determination of coincidence. The mirror-experiment method requires the placement of reflectors on the land being photographed; the mirrors mark pixels in the film which serve as reference points. The correlation-algorithm method determines the correlation-function maximum for the two sections where superimposition is sought. This method was most suitable for the fine-structure landscape sections studied here. M.L.

A78-29829 Orissa, India, land use mapping - A case study of the use of Landsat data in development. W. U. Drewes and J. R. McKenna, Jr. (International Bank for Reconstruction and Development, Washington, D.C.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.

Falls Church, Va., American Society of Photogrammetry, 1977, p. 25-31.

Landsat data have been used to produce land cover - land use association maps in Orissa, India. This was the first regional map produced via computer analysis. Multispectral classification of Landsat computer-compatible tapes was supplemented by statistical tabulations and map overlay products. Transparencies at scale were used for geometric rectification. Field surveys were conducted for ground-truth verification and computer processing was performed on the reclassified imagery. S.C.S.

A78-29830 Progress toward operational use of remote sensing in Canada. W. M. Strome (Canada Centre for Remote Sensing, Ottawa, Canada). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial

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Symposium, Sioux Falls, S. Dak., October 25-29, 1976.

Falls Church, Va., American Society of Photogrammetry, 1977, p. 34-41.

A survey of remote sensing projects in Canada is presented. Particular attention is given to ice reconnaissance, land use mapping, studies of building heat loss, water quality investigations, cartography, wild life monitoring, and forest fire control. Future work is being planned in the areas of disaster monitoring, snow mapping, and hydrographic cartography of coastal areas. S.C.S.

A78-29841 * Techniques for the creation of land use maps and tabulations from Landsat imagery. G. L. Angelici and N. A. Bryant (California Institute of Technology, Jet Propulsion Laboratory, Image Processing Laboratory, Pasadena, Calif.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 162-171. 5 refs.

Methods for creating color thematic maps and land use tabulations, employing both Landsat imagery and computer image processing, are discussed. The system, the Multiple Input Land Use System (MILUS) has been tested in the metropolitan section of Dayton, Ohio. Training areas for land use were first digitized by coordinates and then transformed onto an image of white lines on a black background. This image was added to a Landsat image of the same area. Then multispectral classification was performed. A tape of digitized census tract boundaries was computer interfaced to yield an image of tract boundaries on a background registered to the thematic land-use map. Using a data management system, the data were then used to produce figures for the area and percent of land use in each tract. Future work is expected to convert most of the steps into interactive processing. This would greatly reduce the time needed to edit and register the data sets. S.C.S.

A78-29842 The Landsat imagery analysis package - Automated land use classification and multidimensional geographic analysis. P. A. Tassar and J. C. Eidenshink (South Dakota State Planning Bureau, Pierre, S. Dak.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.

Falls Church, Va., American Society of Photogrammetry, 1977, p. 172-200. 10 refs.

A set of computer programs has been developed to process Landsat computer compatible tapes; the analytic tool has been used for land resource management. Among the functions performed by the programs are computer compatible tape joining and reformatting, production of consecutive scene mosaics, spectral analysis, data rectification, ground truth acquisition and training field selection. In addition, analytic procedures such as clustering, large-area classification, data cleaning, misclassification correction and preparation of line printer displays at reduced scale are incorporated in the system. Multidimensional resource analysis permits production of soil stability maps, land use change assessments and water quality planning surveys. J.M.B.

A78-29852 The strategy and methods for determining accuracy of small and intermediate scale land use and land cover maps. K. A. Fitzpatrick (U.S. Geological Survey, National Center, Reston, Va.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 339-361. 7 refs.

A stratified systematic unaligned point sampling technique has been adopted for determining the accuracy of land use maps having a 1:100,000 scale; point location and areal sampling accuracy assessments are compared. In addition, land use maps on a 1:24,000 scale and a 1:250,000 scale (the latter developed from either high-altitude

photography or Landsat imagery) are also studied in terms of classification accuracy. Two different land cover classification levels are involved in the accuracy assessments, one having less than 10 categories and the other more than 25. Misclassifications of afforesting brushland and urban or built-up regions are mentioned.

J.M.B.

A78-29853 An evaluation of remote sensing techniques for ecological land classification. J. Thie. In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 362-381. 18 refs.

Interpretation techniques were studied for Landsat and airborne imagery of a subarctic ecology near Churchill, Manitoba. Both visual and automated (supervised and unsupervised) techniques were investigated. About 43 different land types could be distinguished through conventional interpretation of aerial photographs, while the Landsat imagery yielded maps with about 10 groups of land types. Visual interpretation of satellite data appeared to be more cost-effective than automated techniques for most ecological mapping problems encountered in Canada. J.M.B.

A78-30234 # The USGS land use and land cover classification system. R. E. Witmer (U.S. Geological Survey, Reston, Va.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 10-19.

Formulation of the land use and land cover classification system adopted by the U.S. Geological Survey for remote sensing data is described. The classification system is designed to provide an interpretation accuracy of at least 85% for the several categories; in addition, the classification is required to be applicable to data acquired at different seasons. Image interpretation procedures and problems of boundary selection for the classifications are discussed. J.M.B.

A78-30235 # Determination of accuracy and information content of land use and land cover maps at different scales. K. Fitzpatrick-Lins and M. J. Chambers (U.S. Geological Survey, Reston, Va.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 41-54.

A78-30237 # Developing and using a geographic information system for handling and analyzing land resource data. K. E. Anderson, S. C. Guptill, C. Hallam, and W. B. Mitchell (U.S. Geological Survey, Geographic Information Systems Branch, Reston, Va.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 67-83.

A78-30239 # Updating land use and land cover maps. V. A. Milazzo, R. A. Ellefsen, and D. W. Schwarz. *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 103-116.

A78-30240 # Applications of land use and land cover maps and data compiled from remotely sensed data. D. B. Gallagher, R. L. Kleckner, and H. F. Lins, Jr. (U.S. Geological Survey, Reston, Va.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 117-125.

Applications of systematically classified and compiled land use and land cover data to an environmental impact study, a coastal zone survey, a river quality assessment, and a study for the Nationwide Outdoor Recreation Plan are considered. The environmental impact study deals with a phosphate strip mine operation in Idaho and identifies not only quarries, gravel pits and stream sedimentation due to the mining operation, but also the proliferating mobile home

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parcs near the mine. The coastal zone survey provides an assessment of the effects caused by offshore oil and gas exploitation, while the recreation area study focuses on the conversion of open land to built-up areas in the vicinity of cities. J.M.B.

A78-30241 # Methods for analysis of the impact of land use on climate. R. W. Pease (California, University, Riverside, Calif.), C. B. Jenner (Wisconsin, University, Milwaukee, Wis.), and J. E. Lewis. *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 126-141.

The influence of land use on local climate is discussed, with attention given to techniques for mapping the distributions of surface energy-exchange phenomena by electrooptical scanning, and the numerical simulation of surface energy balance processes. As an example of land use/climatology studies, a mapping of the Baltimore area through use of an airborne multispectral scanner is described; the scanning imagery yielded data on the build-up of the urban heat island and permitted mapping of surface albedos, as well as energy absorption and emission by the land surface. The problem of translating surface emissivities from remote sensors into surface temperature data is given particular consideration. J.M.B.

A78-30277 A generalized method for environmental surveillance by remote probing. D. T. Gjessing (Forsvarets Forskningsinstitutt, Kjeller, Norway). *Radio Science*, vol. 13, Mar.-Apr. 1978, p. 233-244.

Selective detection and identification methods may improve the sensitivity of environmental surveillance systems that use electrooptical, microwave and computer devices. Essentially, selective detection involves assessment of the target shape and its molecular surface structure to determine an illumination function which gives optimal system sensitivity and minimum background interference. Applications of selective detection and identification to monitoring pollutants, locating oil spills, and remotely sensing vegetation cover and the water content of snow are mentioned. J.M.B.

A78-31452 Research into the structure of power plant plumes (Untersuchung der Struktur von Kraftwerksrauchfahnen). D. Paffrath (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen, West Germany). *Staub - Reinhaltung der Luft*, vol. 38, Mar. 1978, p. 105-110. 19 refs. In German.

In the down-wind area of the RWE power plant Neurath near Grevenbroich the particle number and SO₂-concentration distribution were measured from an airplane. The results of the distributions are discussed and they are used to estimate dispersion parameters. Furthermore emission rates are evaluated, and the results are in rather good agreement with the data which have been made available by the power plant administration. (Author)

A78-31637 An evaluation of precipitation scavenging rates of background aerosol. B. B. Hicks (Argonne National Laboratory, Argonne, Ill.). *Journal of Applied Meteorology*, vol. 17, Feb. 1978, p. 161-165. 17 refs. Research sponsored by the U.S. Department of Energy.

Concentrations of radon daughters in falling rain have been used to derive precipitation scavenging rates of those particles with which radon daughters are associated; presumably these are the particulate component of natural, background aerosol. Scavenging rates ranging from .0001-.001 per sec are deduced from a comparison of the observations with the predictions of simple models of in-cloud scavenging processes. (Author)

N78-16418# Princeton Univ. Observatory, N. J.
APPLICATION OF A FABRY-PEROT INTERFEROMETRY TO REMOTE SENSING OF GASEOUS POLLUTANTS Final Report, Aug. 1971 - Mar. 1975
W. Hayden Smith and Robert A. King. Aug. 1977 144 p
(Contract EPA-68-02-0327; Grant EPA-R-800805)
(PB-273101/6; EPA-600/2-77-154) Avail: NTIS
HC A07/MF A01 CSCL 14B

A method for the remote sensing of molecular species via the rotational Raman effect was developed. The method uses the properties of a scanning Fabry-Perot interferometer to multiplex the spectra in a manner specific for a given species. Furthermore, the method allows the 'in principle' sensitivity of remote pollutants to be increased by as much as 10,000 over the vibrational Raman effect. To achieve this goal, a scheme was developed for the rejection of the Raman spectra of the abundant background gases, N₂ and O₂. This was accomplished efficiently and with little loss of the Raman scattered light from the pollutant species. GRA

N78-16498# Ohio State Univ. Research Foundation, Columbus.
APPLICATION OF FOURIER TRANSFORM SPECTROSCOPY TO AIR POLLUTION PROBLEMS Interim Report
J. G. Calvert, W. H. Chan, E. Niple, R. J. Nordstrom, and J. H. Shaw. Aug. 1977 115 p refs
(Grant EPA-R-803868-1)
(PB-272891/3; EPA-600/3-77-025) Avail: NTIS
HC A06/MF A01 CSCL 04A

Spectra of air samples at ground level of approximately 10m, 100m, and 1km, and solar spectra obtained for solar zenith distances between 40 and 87 degrees were obtained. Examples of these spectra in the region from 1100 to 1200/cm are presented together with spectra calculated from the atmospheric line parameter listing. From the absorption features of fluorocarbon-12 near 1160/cm in solar spectra, a mean tropospheric abundance of 0.34 ppb was estimated. A photochemical cell capable of approximating the solar noon irradiance at ground level between 300 and 400nm and in which path lengths in excess of 200m can be obtained is described. GRA

N78-16508# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SATELLITE REMOTE SENSING STUDY OF THE TRANS-BOUNDARY MOVEMENT OF POLLUTANTS Final Report
C. T. Wezernak and D. R. Lyzenga. May 1977 28 p refs
(Grant EPA-R-803671)
(PB-274069/4; ERIM-115100-2-F; EPA-600/3-77-056) Avail: NTIS
HC A03/MF A01 CSCL 13B

A limit analysis of ERTS (LANDSAT) data of the western basin of Lake Erie and the southern portion of Lake Huron was performed. The ERTS (LANDSAT) data, as recorded on computer compatible tapes, were processed to display surface circulation features, surface suspended solids distribution, surface chlorophyll distribution, and secchi disc transparency. The results demonstrate the potential of satellite remote sensing for monitoring of large water bodies. GRA

N78-17428*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report
Toby N. Carlson, Principal Investigator. 1 Mar. 1978 7 p
ERTS
(Contract NAS5-24264)
(E78-10055; NASA-CR-155549; QR-1) Avail: NTIS
HC A02/MF A01 CSCL 05B

N78-17429*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN Final Report
Takakazu Maruyasu, Principal Investigator. Nov. 1977 180 p refs
Sponsored by NASA. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(E78-10056; NASA-CR-155550) Avail: NTIS
HC A09/MF A01 CSCL 04B

The author has identified the following significant results. In the Plains of Tokachi, where the scale of agricultural field was comparatively large in Japan, LANDSAT data with its accuracy have proved to be useful enough to observe the actual condition

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of agricultural land use and changes more accurately than present methods. Species and ages of grasses in pasture were identified and soils were classified into several types. The actual land cover and ecological environment were remarkably changeable at the rapidly industrialized area by the urbanization in the flat plane and also by the forest works and road construction in the mountainous area. The practical use of the recognition results was proved as the base map of the field survey or the retouching work of the vegetation and land use. There was a 10% cut in cost, labor, and time. Vegetation cover in Tokyo districts was estimated by both the multiregression model and the parametric model. Multicorrelation coefficient between observed value and estimated value was 0.87 and standard deviation was + or - 15%. Vegetation cover in Tokyo was mapped into five levels with equal intervals of 20%.

N78-17443* # Federation of Rocky Mountain States, Inc., Denver, Colo.

A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA: A REPORT ON A LANDSAT AND COMPUTER MAPPING PROJECT, VOLUME 1 Final Report

George Nez, Principal Investigator and Doug Mutter Apr. 1977 25 p refs ERTS
(Contract NAS5-22338)
(E78-10070: NASA-CR-155610) Avail: NTIS
HC A02/MF A01 CSCL 08B

The author has identified the following significant results. New LANDSAT analysis software and linkages with other computer mapping software were developed. Significant results were also achieved in training, communication, and identification of needs for developing the LANDSAT/computer mapping technologies into operational tools for use by decision makers.

N78-17444* # Federation of Rocky Mountain States, Inc., Denver, Colo.

A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA: A REPORT ON A LANDSAT AND COMPUTER MAPPING PROJECT, VOLUME 2 Final Report

George Nez, Principal Investigator and Doug Mutter Apr. 1977 119 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-22338)
(E78-10071: NASA-CR-155611) Avail: NTIS
HC A06/MF A01 CSCL 08B

The author has identified the following significant results. The project mapped land use/cover classifications from LANDSAT computer compatible tape data and combined those results with other multisource data via computer mapping/compositing techniques to analyze various land use planning/natural resource management problems. Data were analyzed on 1:24,000 scale maps at 1.1 acre resolution. LANDSAT analysis software and linkages with other computer mapping software were developed. Significant results were also achieved in training, communication, and identification of needs for developing the LANDSAT/computer mapping technologies into operational tools for use by decision makers.

N78-17445* # Federation of Rocky Mountain States, Inc., Denver, Colo.

A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA: A REPORT ON A LANDSAT AND COMPUTER MAPPING PROJECT, VOLUME 3 Final Report

George Nez, Principal Investigator and Doug Mutter Apr. 1977 766 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-22338)
(E78-10072: NASA-CR-156676) Avail: NTIS
HC A99/MF A01 CSCL 08B

For abstract, see N78-17444.

N78-17446* # Missouri Univ., Columbia.

MAPPING LAND COVER FROM SATELLITE IMAGES: A BASIC, LOW COST APPROACH

C. Dale Elifrits, Terry W. Barney, David J. Barr, and C. J. Johannsen Jan. 1978 24 p refs
(Contract NAS8-31767)
(NASA-CR-2952; M-247) Avail: NTIS HC A02/MF A01 CSCL 08B

Simple, inexpensive methodologies developed for mapping general land cover and land use categories from LANDSAT images are reported. One methodology, a stepwise, interpretive, direct tracing technique was developed through working with university students from different disciplines with no previous experience in satellite image interpretation. The technique results in maps that are very accurate in relation to actual land cover and relative to the small investment in skill, time, and money needed to produce the products. Author

N78-17496* # National Aeronautics and Space Administration, Washington, D. C.

DETERMINATION OF TRACES OF MINERAL OIL IN WATER

Friedrich Scholl and Hannelore Fuchs Sep. 1976 29 p refs Transl. into ENGLISH from Bosch Tech. Ber. (West Germany), v. 2, no. 5, Nov. 1968 p 235-244 Transl. by Transemantics, Inc., Washington, D.C. Original doc. prep. by Bosch (Robert) G.m.b.H., Stuttgart, West Germany
(NASw-2792)
(NASA-TT-F-17230) Avail: NTIS CSCL 13B

Petrol, heavy oil and other mineral oil products can produce contamination of water if stored or handled carelessly. The determination of traces of mineral oil in water is hence very important in practice. The processes for this determination are compared and critically evaluated. An improved infrared-spectroscopic process is described. The limits of error in determining traces of mineral oil of unknown origin and composition in water can be reduced to about plus or minus 10 percent. Author

N78-18128* # National Bureau of Standards, Washington, D. C. Inst. for Materials Research.

METHODS AND STANDARDS FOR ENVIRONMENTAL MEASUREMENT. PROCEEDINGS OF THE MATERIALS RESEARCH SYMPOSIUM Final Report

William H. Kirchhoff Nov. 1977 653 p refs Symp. held at Gaithersburg, Md., 20-24 Sep. 1976
(PB-275008/1; NBS-SP-464; LC-76-608384) Avail: NTIS
HC A99/MF A01 CSCL 07D

Extended abstracts of the invited and contributed papers on topics of concern at the symposium were presented. Some topics discussed were: (1) the analysis of trace organic compounds in water; (2) multielement analysis; (3) the physical and chemical characterization of aerosols; (4) the application of laser technology to atmospheric monitoring; and (5) ambient air quality monitoring. The chemical characterization of inorganic and organometallic constituents was also discussed. Author

N78-18488* # Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

LANDSAT APPLICATION OF REMOTE SENSING TO SHORELINE-FORM ANALYSIS Final Report, 3 Apr. 1975 - 3 Jan. 1978

Robert Dolan, Bruce Hayden, and Jeffrey Heywood, Principal Investigators Mar. 1978 119 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-20999)
(E78-10079: NASA-CR-155741) Avail: NTIS
HC A06/MF A01 CSCL 05B

The author has identified the following significant results. Using Assateague Island, Cape Hatteras, and Cape Lookout, significantly high correlations were found for most of the six barrier island sections that were examined. Relationships were not consistent from island to island. It was concluded that coastal vulnerability to storm damage can not be assessed based on

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coastal orientation alone. When orientation data were combined with erosion data for individual barrier islands, the relationship could be used as a basis for barrier island classification. A method was developed to obtain large amounts of historical data on surface coastal process from aerial photography, which was called the orthogonal grid address system. Data on shoreline change and overwash penetration gathered on over 400 km of the mid-Atlantic coast, are being used by various federal and state agencies for planning purposes.

N78-19575* Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM LANDSAT DATA Final Report
 M. Griggs, Principal Investigator 27 Jan. 1978 71 p refs ERTS
 (Contract NAS5-20899)
 (E78-10097; NASA-CR-155788; SAI-78-525-LJ) Avail: NTIS HC A04/MF A01 CSCL 04A

The author has identified the following significant results. A large set of LANDSAT 2 data, obtained at San Diego, showed excellent linear relationships, particularly for MSS 5 and MSS 6, between the radiance over the ocean and the atmospheric aerosol content. Two other data points obtained at Adrigole, Ireland, representing a different ocean and a different ground truth instrument, showed very good agreement with the San Diego data. It appeared that the technique could be used for global monitoring of the atmospheric aerosol content over the oceans. Results obtained at several inland bodies of water showed that MSS 4, MSS 5, and MSS 6 cannot be used due to the effect of water pollution generally present. However, the LANDSAT 1 results suggested that MSS 7, which operates at longer wavelengths, was not very sensitive to water pollution, and might be useful for inland measurements of aerosol content. Use of the longer wavelength would also minimize the effects of adjacent high albedo land, since atmospheric scattering was reduced at longer wavelengths.

N78-19581* National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF SATELLITE PICTURES TO CENSUS OPERATIONS. BOLIVIAN EXPERIENCE IN CENSUS-TAKING OF POPULATION AND RESIDENCES
 Mar. 1978 14 p Transl. into ENGLISH of "Aplicaciones de las Imágenes de Satélite A Operaciones Censales. Experiencia Boliviana en el Censo de Población y Vivienda". Rept., Inst. Nacl. de Estadística, Min. de Planeamiento y Coord., Rep. of Bolivia, La Paz, Bolivia, Aug. 1977 p 1-14 Transl. by SCITRAN, Santa Barbara, Calif.
 (Contract NASw-2791)
 (NASA-TM-75090) Avail: NTIS HC A02/MF A01 CSCL 05B

The use of photographs from satellites to assist in census operations is discussed. Principles of selecting the sources of cartographic information are outlined, and the use of LANDSAT pictures in census cartography is examined. Author

N78-19585* Army Cold Regions Research and Engineering Lab., Hanover, N. H.
APPLICATIONS OF REMOTE SENSING IN THE BOSTON URBAN STUDIES PROGRAM, PART 1
 Carolyn J. Merry and Harlan L. McKim Jun. 1977 22 p refs (AD-A049285; CRREL-77-13-Pt-1) Avail: NTIS HC A02/MF A01 CSCL 13/2

The cost effectiveness of remote sensing techniques was compared to that of the conventional techniques used by the U.S. Army Engineer Division, New England, in the Boston Harbor - Eastern Massachusetts Metropolitan Area study. A total of 6 level I, 18 level II, and 18 level III land use categories were mapped from NASA RB-57/RC-8 high altitude aircraft photography for six selected 7 1/2-minute quadrangles located in the Boston area. Watershed and political boundaries could not be mapped from the NASA photography. Impervious surfaces and curb lengths were mapped from low altitude aircraft photography obtained with a Zeiss RMK 15/23 camera system

(measured scale 1:3500) for two sites in the Boston South and Newton quadrangles. The remote sensing procedures used in this study usually provided much greater detail than conventional procedures. The remote sensing procedures were not always cost-effective when compared to the conventional procedures, but they were always more accurate. Therefore, remote sensing techniques should be used and appropriate photographic resolution and scale factors taken into consideration when mapping land use, curb density and impervious surfaces for use in the STORM (storage, treatment, overflow, runoff) model.

Author (GRA)

N78-19586* Army Cold Regions Research and Engineering Lab., Hanover, N. H.
APPLICATIONS OF REMOTE SENSING IN THE BOSTON URBAN STUDIES PROGRAM, PART 2
 Carolyn J. Merry and Harlan L. McKim Jun. 1977 55 p (AD-A049286; CRREL-77-13-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 13/2
 For abstract, see N78-19585.

N78-20570* Michigan State Univ., East Lansing.
USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION Semiannual Progress Report, Jun. - Nov. 1977
 Myles Boylan, Principal Investigator 14 Mar. 1978 57 p refs ERTS
 (Grant NGL-23-004-083)
 (E78-10103; NASA-CR-155968) Avail: NTIS HC A04/MF A01 CSCL 08B

The author has identified the following significant results. By utilizing remote sensing techniques, it was possible to accurately inventory a relatively large area for sand mining impact on protection and management of shoreland dunes within a limited time period and at a relatively low cost. Analysis of two sample areas selected from the Grand Mere area after prohibition of off-road-vehicle use indicated an increase in vegetation regrowth of 8.52% for sample area 1 and of 4.44% for sample area 2.

N78-20671* Lincoln Lab., Mass. Inst. of Tech., Lexington.
TUNABLE LASER SPECTRAL SURVEY OF MOLECULAR AIR POLLUTANTS Final Report
 A. Mooradian and A. S. Pine May 1977 116 p refs (Grant NSF AEN-71-01922-A03)
 (PB-276188/0; NSF/RA-770379) Avail: NTIS HC A06/MF A01 CSCL 07D

High resolution near-infrared spectra of several hydrocarbons and other light molecules of atmospheric significance were surveyed and cataloged using a difference-frequency laser spectrometer. The molecular spectral surveys and analyses presented provide information on spectral signatures absolute absorption intensities and pressure and temperature effects. High resolution spectra of methane and formaldehyde in the region of their fundamental C-H stretching bands are presented. Also discussed are some instrumentation advances in the laser spectrometer system which improves its precision and data handling capabilities. GRA

N78-21516* South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Jan. - Mar. 1978
 Donald G. Moore, Principal Investigator and J. Heilman Mar. 1978 4 p ERTS
 (Contract NAS5-24206)
 (E78-10111; NASA-CR-156127) Avail: NTIS HC A02/MF A01 CSCL 08H

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N78-21526* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATION OF REMOTE SENSING TO THE CHESAPEAKE BAY REGION. VOLUME 2: PROCEEDINGS

W. T. Chen, ed., G. W. Freas, Jr., ed., G. D. Hickman, ed. (Maryland Univ., College Park), D. A. Pemberton, ed. (Maryland Univ., College Park), T. D. Wilkerson, ed. (Maryland Univ., College Park), I. Adler, ed. (Maryland Univ., College Park), and V. J. Laurie, ed. (EPA, Washington, D.C.) Feb. 1978 388 p refs Conf. held at Berkeley Springs, W. Va., 12-15 Apr. 1977; sponsored by NASA, EPA, and Maryland Univ., College Park (NASA-CP-6: G-7719) Avail: NTIS HC A17/MF A01 CSCL 08J

A conference was held on the application of remote sensing to the Chesapeake Bay region. Copies of the papers, resource contributions, panel discussions, and reports of the working groups are presented.

N78-21528* Environmental Protection Agency, Philadelphia, Pa.

THE CHESAPEAKE BAY PROGRAM: AN OPPORTUNITY TO USE AN INNOVATIVE MONITORING TECHNIQUE

Leonard Mangiaracina *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 11-15

Avail: NTIS HC A17/MF A01 CSCL 05A

The goal of this program is to develop a management system that will protect and preserve the water quality of the Chesapeake Bay by effectively managing its uses and resources. To achieve this goal, three major objectives must be accomplished: (1) Determine what units of government have management responsibility for the environmental quality of the Chesapeake Bay, also to define how such management responsibility can best be structured so that communications and coordination can be improved between the respective units of government, research, educational institutions, concerned groups, and individuals. (2) Assess the principal factors having an adverse impact on the environmental quality of the Chesapeake Bay. Following this assessment and review of ongoing research, direct and coordinate research and abatement programs that will most effectively address these factors, and (3) analyze all environmental sampling data now being collected on the Chesapeake Bay and suggest and undertake methods for improving this data collection, and to establish a continuing capability for collecting, storing, analyzing, and disseminating these data. Author

N78-21532* Regional Planning Council, Baltimore, Md. **LANDSAT AND OTHER SENSOR DATA FOR LAND-USE PLANNING IN THE BALTIMORE AREA**

James Manley *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 33-35 refs

Avail: NTIS HC A17/MF A01 CSCL 05A

Investigations of the current uses of the LANDSAT sensor data revealed that there were no successful uses of LANDSAT data in identifying specific urban uses other than densities of residential use, paved areas, and roof tops. Information was merged on developed land uses from the air photointerpretation and the land cover from the LANDSAT sensors. It was expected that this would give the most accurate results by taking results from each technique when they were best. Author

N78-21534* Maryland Dept. of State Planning, Baltimore. **MARYLAND AUTOMATED GEOGRAPHIC INFORMATION SYSTEM**

Edwin L. Thomas *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 45-47

Avail: NTIS HC A17/MF A01 CSCL 05B

A computer based system designed for storing geographic data in a consistent and coordinated manner is described. The

data are stored, retrieved, and analyzed using a 400 km sq/acre cell. Stored information can be displayed on computer maps in a manner similar to standard map graphics. The data bank contains various information for performing land use analysis in a variety of areas. Author

N78-21538* Maryland Univ., Frostburg. Center for Environmental and Estuarine Studies.

USE OF REMOTE SENSING TECHNOLOGY PROVIDED BY THE NASA/WFC CHESAPEAKE BAY ECOLOGICAL PROGRAM

Dan M. Harman, Kent B. Fuller, and Dale B. Fuller *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 103-109 refs

Avail: NTIS HC A17/MF A01 CSCL 13B

Use of remote sensing technology provided through the NASA/Wallops Chesapeake Bay Ecological Program was investigated by means of extensive interviews with users. Since the inception of the Program four years ago, the technology has been used in 136 different managerial projects. Sixty-five regional managerial agencies took part in projects that the authors categorized as socioeconomic, political/managerial, monetary, legal, and other. Remote sensing technology was considered successful in 88.6 percent of the completed projects and unsuccessful in 2.8 percent. Author

N78-21548* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE IN-SITU ELEMENTAL ANALYSIS SYSTEMS FOR UNDERWATER APPLICATION

Jacob I. Trombka and Kurt R. Stehling (NOAA, Rockville, Md.) *In* its Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 217-221

Avail: NTIS HC A17/MF A01 CSCL 05B

The systems approach, theoretical measurement calculations, and preliminary measurements to be used in monitoring and mapping pollutants (such as traces of heavy metals) in the Chesapeake Bay are discussed. A neutron gamma-ray method is under development for demonstrating the system. The excitation source to be used is a machine accelerator using a deuterium/tritium reaction to produce 14-MeV neutrons. The neutrons excite characteristic gamma ray emission from the neutron irradiated surface. The discrete line emission produced can be used to infer both qualitative and quantitative elemental composition. A data preprocessor will accumulate, digitize, store, format, and prepare the data for transmission which can be accomplished by telephone, microwave, and possibly satellite link to central processors. Author

N78-21548* Environmental Measurements, Inc., Annapolis, Md.

WORK ON POWER-PLANT (AIR) PLUMES INVOLVING REMOTE SENSING OF SO₂

Charles L. White, Jr. *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 239-247 refs

Avail: NTIS HC A17/MF A01 CSCL 13B

Acquisition of air quality and concurrent meteorological data was used for dispersion model development and plant siting needs of the Maryland power plants. One of the major instruments in these studies was the Barringer correlation spectrometer, a remote sensor, using atmospherically scattered sunlight that was used to measure the total amount of SO₂ in a cross section of the plume. Correlation spectrometer and its role in this measurement program are described. Author

N78-21550* Maryland Dept. of Health and Mental Hygiene, Baltimore.

WATER QUALITY AND SHELLFISH SANITATION

Max Eisenberg *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 267-268

Avail: NTIS HC A17/MF A01 CSCL 08A

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The use of remote sensing techniques for collecting bacteriological, physical, and chemical water quality data, locating point and nonpoint sources of pollution, and developing hydrological data was found to be valuable to the Maryland program if it could be produced effectively and rapidly with a minimum amount of ground corroboration. Author

N78-21556*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ROLE OF REMOTE SENSING IN DOCUMENTING LAND USE AS IT AFFECTS THE BAY AND BAY USE AS IT AFFECTS THE LAND

William F. Rhodes, John M. Garber, John M. Hill, and Walter E. Raum *In its Appl. of Remote Sensing to the Chesapeake Bay Reg.* Feb. 1978 p 311-313

Avail: NTIS HC A17/MF A01 CSCL 08B

The remote sensing technology required for locating, identifying, and monitoring nonpoint, or diffuse, pollution caused by improper land use practices is discussed. Establishment of an information system to include all remote sensed data acquired on the Bay and to disseminate information to users is considered. J.M.S.

N78-21558*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POSSIBLE ROLE OF REMOTE SENSING FOR INCREASING PUBLIC AWARENESS OF THE CHESAPEAKE BAY ENVIRONMENT

Thomas D. Wilkerson, Patricia A. Maher, Gloria Billings, Philip J. Cressy, John W. Jarman, Norman H. MacLeod, Jacob I. Trombka, and Tom Wisner *In its Appl. of Remote Sensing to the Chesapeake Bay Reg.* Feb. 1978 p 323-326 refs

Avail: NTIS HC A17/MF A01 CSCL 05B

Application of remote sensing techniques to the study of the Chesapeake Bay and the availability of the resulting information are discussed in terms of public awareness of the Chesapeake Bay, its total environment, and the need to protect that environment and to preserve the Bay. Recommendations given include: (1) continue the study of remote sensing technology and its use in the Chesapeake Bay region; (2) emphasize the importance of LANDSAT imagery to the evolution of remote sensing technological developments and the awareness of the environment and its changes; (3) increase dissemination of information of the environmental applications of remote sensing technology to the public; (4) design surveys of the Chesapeake Bay environment and its manmade changes; and (5) establish a coordinating regional institution to develop a management plan for the Chesapeake Bay. J.M.S.

N78-21561*# Maryland-National Capital Park and Planning Commission, Silver Spring, Md.

APPLICATION OF A COMPUTERIZED ENVIRONMENTAL INFORMATION SYSTEM TO MASTER AND SECTOR PLANNING

John C. Stewart *In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg.* Feb. 1978 p 359-371 refs

Avail: NTIS HC A17/MF A01 CSCL 05B

A computerized composite mapping system developed as an aid in the land use decision making process is described. Emphasis is placed on consideration of the environment in urban planning. The presence of alluvium, shallow bedrock, surface water, and vegetation growth are among the environmental factors considered. An analysis of the Shady Grove Sector planning is presented as an example of the use of computerized composite mapping for long range planning. J.M.S.

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GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A78-22849 # The topographer in service of the common good in territorial surveying (Il topografo al servizio della collettività per la conoscenza del territorio). A. Selvini (Società Italiana di Fotogrammetria e Topografia, Milan, Italy). *Ingegneria*, Nov.-Dec. 1977, p. 325-346. 47 refs. In Italian.

Applications of aerial photography to land use planning, hydrological surveys, large-scale engineering projects, crop surveys, and the conservation of monuments and recreation areas are discussed. Attention is given to the organizational structure and educational qualifications of survey teams in the USSR and Western Europe, particularly in Italy. Case studies focus on the role of aerial reconnaissance in urban reconstruction projects following World War II, the mapping of a park in Italy, and land-use surveys in the Federal Republic of Germany. J.M.B.

A78-22862 Terrain classification using SLAR imagery - A geomorphological approach. R. A. van Zuidam (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal*, no. 4, 1977, p. 705-716. 14 refs.

Terrain analysis and classification for the Amazon region of Colombia were performed through use of Side-Looking Airborne Radar (SLAR) images for a region of approximately 380,000 sq km. The analysis was based principally on 1:200,000 mosaics with good stereoscopic characteristics and adequate resolution. Investigations of an area with strong ravine development, a quartzitic sandstone plateau, and a region with mixed savanna and tropical rainforest were conducted. Additional aerial photographs and Landsat imagery provided a supplement to the SLAR images. J.M.B.

A78-24171 # The complex cartographic inventory taking of natural resources on the basis of space data (O kompleksnoi kartograficheskoi inventarizatsii prirodnykh resursov na osnove kosmicheskoi informatsii). G. T. Beregovoi (Tsentr Podgotovki Kosmonavtov, USSR) and Iu. P. Kienko (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr Priroda, USSR). *Geodeziia i Kartografiia*, Nov. 1977, p. 12-15. In Russian.

A78-26526 # A survey of earth-surface observation satellites and the interface between remote sensor and attitude control system. M. J. Hammond (British Aircraft Corp., Ltd., Electronic and Space Systems Div., Bristol, England). *ESA Journal*, vol. 1, no. 4, 1977, p. 327-343. 12 refs.

A brief survey of earth-observation satellites is presented, including possible future developments. Consideration is given to the flow of information from remote sensor to user and the areas where satellite attitude measurement and control have a direct impact on reconstruction of the original scene. An overview of the performance specifications for and implementation of candidate systems is presented, which is concluded by an assessment of a 'common-bus' philosophy related to various system options. (Author)

A78-27562 # The determination of the geoid in Austria (Zur Geoidbestimmung in Österreich). K. Rinner and H. Moritz. *Österreichische Akademie der Wissenschaften, Mathematisch-naturwissenschaftliche Klasse, Sitzungsberichte, Abteilung 2*, vol. 186, no. 1-3, 1977, p. 171-177. In German.

A geoid is an imaginary surface of the earth which coincides with the mean sea level over the ocean and its extension under the

continents. A knowledge of the geoid of a country is required for scientific reasons, for geophysical explorations, for the determination of altitudes, and for the exact reduction of measured values in the study of geodynamic motions. The most accurate method for the determination of the local characteristics of the geoid even today is still the classical astrogeodetic method. Gravity measurements and satellite data are required to incorporate the local geoid in the global framework. A description of the astrogeodetic method is presented and the current status of geoid determination in Austria is evaluated, taking into account additional data which are needed and the approaches which can be employed to provide these data. G.R.

A78-28384 The role of data obtained by remote sensing in structural generalizations for morphological cartography (Apports de données obtenues par télédétection à la généralisation structurale en cartographie morphologique). S. J. Paul (Paris VIII, Université, Paris, France). (*Conférence Cartographique Internationale, 8th, Moscow, USSR, Aug. 1976.*) In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1.

Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 119-134. 42 refs. In French.

To fill a gap in the medium-scale (i.e., the 1:200,000 to 1:400,000 range) imagery of the Massif Central in France, side-looking airborne radar observations at a scale very near 1:350,000 have been undertaken. The previously available geological maps of the region, which is characterized by extinct volcanoes, are reviewed. The credibility of conventional methods of structural generalization for the production of morphological cartography is also critiqued. J.M.B.

A78-28385 Evaluation of the role of remote sensing techniques in geological cartography (Evaluation de l'apport des techniques de télédétection en cartographie géologique). J.-Y. Scavic and G. Weecksteen (Bureau de Recherches Géologiques et Minières, Orléans, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 135-139. In French.

Color imagery and infrared color imagery are used to improve geological mapping at the 1:50,000 scale; the imagery is particularly helpful in distinguishing faults and identifying secondary dolomitized zones. In addition, thermal imagery provides information on faults and sink holes. Multispectral scanning imagery is found to be of little interest in this case. J.M.B.

A78-28387 An approach to soil cartography through photographic analysis of images (Approche de la cartographie des sols par l'analyse photographique des images). B. Naert (Institut National de la Recherche Agronomique, Montpellier, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 153-165. In French.

Soil mapping based on color infrared imagery, multispectral scanning data and radar imagery is discussed. Attention is given to such data processing problems as color selection, color combination, and density normalization; a photographic processing technique which permits measurement and classification of images isolated by equidensity procedures also receives consideration. In addition to soil mapping, land-management mapping and cropland classifications are mentioned. J.M.B.

A78-29773 Rigorous uncurving formula (Strenge Entkrümmungsformeln). K. Hubeny (Graz, Technische Universität, Graz, Austria). *Bildmessung und Luftbildwesen*, vol. 46, Mar. 1, 1978, p. 35-38. In German.

With respect to a problem associated with aerial surveying, rigorous formulas are derived for converting the reference plane

03 GEODESY AND CARTOGRAPHY

equivalent to the earth's curved surface into a true plane. The parametric representation of the ellipsoid by geodetic polar coordinates (Weingarten power series) enables the transformation of any land-survey coordinates into Cartesian tangential coordinates, and vice versa. The formulas are accurate to within a few millimeters in an area of 200 by 200 sq km. M.L.

A78-29774 Optical correction of earth-curvature and refraction effects in aerial photographs by means of spherically ground compensation plates (Die optische Korrektur des Erdkrümmungs- und des Refraktionseinflusses in Luftbildern durch sphärisch geschliffene Kompensationsplatten). D. Kahler. *Bildmessung und Luftbildwesen*, vol. 46, Mar. 1, 1978, p. 39-46. 11 refs. In German.

The use of spherical compensation plates in conjunction with formulas derived here permits almost complete correction of earth-curvature and refraction effects for direct-viewing instruments and provides a good approximation to correctness for perspective-viewing instruments. The manufacture of spherical surfaces is simpler and cheaper than the manufacture of aspherical surfaces, but every camera and every height would require a specific compensation plate. Use of spherical compensation plates is recommended for simple plotting instruments used to compile small-scale maps. M.L.

A78-30715 # Preliminary program of satellite missions involving scientific and practical aspects of the Doppler technique (Wstępny program prac satelitarnych uwzględniający naukowe i praktyczne aspekty zastosowania techniki dopplerowskiej). J. Siedziński. *Geodezja i Kartografia*, vol. 27, no. 1, 1978, p. 3-16. 18 refs. In Polish.

The paper describes a satellite program concerned with the development of the Doppler-tracking technique of celestial geodesy. A general review is presented of Doppler techniques and equipment and to sources of tracking error. Particular attention is given to Doppler methods of translocation for the determination of coordinate differences. The utilization of Doppler techniques in the Polish celestial-geodesy program is considered. B.J.

A78-32212 Satellite inferred surface albedo over northwestern Africa. A. A. Rockwood and S. K. Cox (Colorado State University, Fort Collins, Colo.). *Journal of the Atmospheric Sciences*, vol. 35, Mar. 1978, p. 513-522. 17 refs. NOAA-supported research; NSF Grants No. OCD-72-01681-A03; No. OCD-74-21678.

A technique has been developed from simultaneous satellite and aircraft data that allows the magnitude and gradient of the earth's surface albedo to be inferred from satellite measurements of the earth-atmosphere system brightness. The technique uses the visible brightness observations from the SMS-1 geosynchronous satellite made during the GARP Atlantic Tropical Experiment (GATE) in 1974. Direct albedo measurements from aircraft verified an albedo range of from 50% over the Sahara Desert to 7% over the wet tropical rainforests. The technique is used to study the changes in the physical characteristics of the surface of northwestern Africa's Sahel region between July and September, 1974. Changes in the gradient of surface albedo and areal extent of various vegetation types are inferred. The albedo values calculated through the application of this technique should be incorporated into the numerical and analytic models of the atmosphere that have recently been used to study local circulation patterns and precipitation trends. (Author)

N78-16516 Stanford Univ., Calif.
THE DETERMINATION OF FAULT MODELS FROM GEODETIC DATA Ph.D. Thesis

William Scott Dunbar 1977 233 p
Avail: Univ. Microfilms Order No. 77-25658

Large scale features of the seismic cycle as observed by means of geodetic data are discussed. The basic equations of dislocation theory are derived. Methods of modelling faults either as a specified dislocation or as a stress release over a rectangular region in an elastic halfspace are presented. Different types of boundary conditions may be placed on the fault surface, affording

the possibility of modelling faults quite realistically. Equations relating the stress release to the amount of fault slip are used as a means of determining geometrical constants for the estimation of stress drops on finite rectangular faults. Least squares is proposed as a method of determining the amount of slip on a dislocation model required to satisfy observed geodetic data.

Dissert. Abstr.

N78-17463# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.

AN AUTOMATED PROCEDURE FOR SLOPE MAP CONSTRUCTION. VOLUME 1: DESCRIPTION AND INSTRUCTIONS FOR USE OF THE AUTOMATED PROCEDURE Final Report, 1 Jun. 1975 - 30 Jun. 1976

Horton Struve Oct. 1977 105 p refs

(DA Proj. 1E8-64803-M-730)

(AD-A047794; AEWES-TR-M-77-3-Vol-1)

Avail: NTIS

HC A06/MF A01 CSCL 09/2

An automated procedure for constructing slope maps was developed and demonstrated in this study. The procedure consists of three sequential parts: (1) input of surface elevation values by means of a matrix of elevation values referred to as an elevation grid array, (2) calculation of slope magnitudes and directions by the computer program SLOPEMAP, and (3) construction of slope maps using various SLOPEMAP output products. The form of input elevation data selected for use by SLOPEMAP to be prepared in advance of program execution is an orthogonal two-dimensional matrix, each element of which is the elevation of the topographic surface at that matrix (or grid) point. At run time, SLOPEMAP inputs these elevation values and calculates the slope magnitude and direction of each input grid point by employing approximation methods that use the elevation values of the grid point in question and its nearest and next nearest neighbors. Then, depending on the selected user options, the calculations are recorded or displayed in one or more of the following forms: (1) printer swath dumps, (2) magnetic tapes, (3) punched cards, and/or (4) drum or cathode ray tube (CRT) graphic plots that delineate slope classes selected by the user. GRA

N78-17506# Center for the Environment and Man, Inc., Hartford, Conn.

OPTIMUM SITE EXPOSURE CRITERIA FOR SO2 MONITORING Final Report

Robert J. Ball and Gerald E. Anderson Apr. 1977 181 p refs

(Contract EPA-68-02-2045)

(PB-274037/1; EPA-450/3-77-013)

Avail: NTIS

HC A09/MF A01 CSCL 13B

Site selection procedures were prepared for specific site types each of which was associated with either a grouping of siting objectives or with an individual objective. Detailed procedures are provided for selecting sites to measure regional mean concentrations, interregional SO2 transport, representative concentrations for areas of various sizes, peak concentrations in urban areas, and emergency episode levels. Recommendations and the rationale for inlet height and orientation, and for minimizing undue influence from nearby sources are presented. Sources of special information and data relevant to selecting specific sites and guidelines for determining locations of sites for satisfying specific objectives are provided in a series of appendices. GRA

N78-19563*# Geological Survey, Denver, Colo.
THE MIXTURE PROBLEM IN COMPUTER MAPPING OF TERRAIN: IMPROVED TECHNIQUES FOR ESTABLISHING SPECTRAL SIGNATURES, ATMOSPHERIC PATH RADIANCE, AND TRANSMITTANCE Final Report, 1 Jul. 1972 - 10 May 1974

Harry W. Smedes, Principal Investigator, Roland L. Hulstrom (Martin Marietta Aerospace Corp., Denver, Colo.), and K. Jon Ranson (Colorado State Univ., Fort Collins) 15 Mar. 1978 66 p refs Presented at Proc. of the NASA Earth Resources

Survey Symp., Houston, Tex., 8-13 Jun. 1975 Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (NASA Order S-70243-AG) (E78-10084; NASA-CR-155762) Avail: NTIS HC A04/MF A01 CSCL 08G

N78-19572* Geological Survey, Denver, Colo.
PROPOSAL FOR A STUDY OF COMPUTER MAPPING OF TERRAIN USING MULTISPECTRAL DATA FROM ERTS-A FOR THE YELLOWSTONE NATIONAL PARK TEST SITE Final Report, 15 Jun. 1972 - 1 Nov. 1973

Harry W. Smedes, Principal Investigator, Ralph R. Root (National Park Service, Denver, Colo.), Norman E. G. Roller (Environmental Research Inst. of Michigan, Ann Arbor), and Don Despain (National Park Service, Yellowstone National Park, Wyoming) 15 Mar. 1978 33 p refs Presented at 9th Intern. Symp. of Remote Sensing of Environment, Ann Arbor, Mich., 15-19 Apr. 1974 Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (NASA Order S-70243-AG) (E78-10094; NASA-CR-155776) Avail: NTIS HC A03/MF A01 CSCL 08B

The author has identified the following significant results. A terrain map of Yellowstone National Park showed plant community types and other classes of ground cover in what is basically a wild land. The map comprised 12 classes, six of which were mapped with accuracies of 70 to 95%. The remaining six classes had spectral reflectances that overlapped appreciably, and hence, those were mapped less accurately. Techniques were devised for quantitatively comparing the recognition map of the park with control data acquired from ground inspection and from analysis of sidelooking radar images, a thermal IR mosaic, and IR aerial photos of several scales. Quantitative analyses were made in ten 40 sq km test areas. Comparison mechanics were performed by computer with the final results displayed on line printer output. Forested areas were mapped by computer using ERTS data for less than 1/4 the cost of the conventional forest mapping technique for topographic base maps.

N78-19583# Synectics Corp., Allison Park, Pa.
THE CARTOGRAPHIC SYSTEM Final Report
John Decker, Aldo DiPasqua, and Allen Lazzara Nov. 1977 64 p refs
(Contract F30602-75-C-0329)
(AD-A049228; C-70679-W; RADC-TR-77-373) Avail: NTIS HC A04/MF A01 CSCL 08/2

This report describes a cartographic digitizing system developed for the Instituto Geografico Militare Italiano. The cartographic system was designed to provide a means to rapidly acquire digital files from analog cartographic data using manual and computer interactive techniques. This objective is effected by the use of tutorial displays which guide the operator in the digitizing session and indicate his rate of accomplishment. The system provides for verification plotting on a high speed drum plotter and for final product plotting on the IGMI contraves plotter. Author (GRA)

N78-20578# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS ON MAPPING AND TOPOGRAPHIC MEASUREMENTS. SERIES 1: ORIGINAL CONTRIBUTIONS, ISSUE NO. 72 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE, HEFT NR. 72]
1977 122 p refs In GERMAN; ENGLISH summaries Presented at the 13th Meeting of the Working Group Automation in der Kartographie, Wiesbaden, 15-16 Sep. 1976
Avail: NTIS HC A06/MF A01

Topics are presented in the field of computer applications to mapping. Several computerized digitizing systems for cartography are discussed as well as peripheral equipment such as drafting machines.

N78-20579# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

AUTOMATIC METHODS FOR SOLVING THE GENERALIZATION PROBLEM [WEGE DER AUTOMATISIERUNG ZUR LOESUNG DES GENERALISIERUNGSPROBLEMS]

Arno Berger In its Rept. on Mapping and Topographic Meas. 1977 p 5-8 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A06/MF A01

Different methods of automating cartographic generalization on topographic maps are described and their importance as to the simplification of the generalization problem by manipulating the map design is emphasized. It is further required that, for the benefit of a swift solution of the manifold generalization tasks, either machine functions or special setups (e.g. binary image processing) be also applied to scales larger than 1:200000. For this purpose, it would be desirable that map specifications should be examined as to adequate information content, and that map design be adapted to automation. Author (ESA)

N78-20580# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

KARTOSCAN, A NEW DIGITAL SCANNER FOR CARTOGRAPHY [KARTOSCAN, EIN NEUES DIGITALES AUFNAHMEGERAET FUEER DIE KARTOGRAPHIE]

Otto Hofmann In Inst. fuer Angew. Geodaesie Rept. on Mapping and Topographic Meas. 1977 p 9-13 In GERMAN; ENGLISH summary

Avail: NTIS HC A06/MF A01

A flat-bed scanner was developed for the digitizing of all kinds of graphic originals. The scanner is equipped with the latest, highly resolving photo sensors scanning the original in raster and areal form. Extensive software packages complete the device, thus making it a universally usable aid to cartography. Author (ESA)

N78-20581# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

ESSENTIAL ASPECTS OF THE CONCEPTION AND APPLICATION OF THE DIGITAL CARTOGRAPHIC DRAFTING MACHINE OF THE ETH ZURICH [WESENTLICHE ASPEKTE DER KONZEPTION UND ANWENDUNG DER DIGITALEN KARTOGRAPHISCHEN ZEICHENANLAGE DER ETH ZUERICH]

Christian Hoinkes In Inst. fuer Angew. Geodaesie Rept. on Mapping and Topographic Meas. 1977 p 15-37 In GERMAN; ENGLISH summary

Avail: NTIS HC A06/MF A01

A complete system for computer-aided digitizing, processing, and final drafting of cartographic data was installed at the Department of Cartography of the Swiss Federal Institute of Technology (ETH) in Zurich. The basic ideas behind the systems concept and the configuration of equipment are described. Some practical examples are given of the use of the system, experience so far briefly described, and some hints are made at the main directions of future application of the system. Author (ESA)

N78-20582# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

AUTOMATED CARTOGRAPHY IN BAVARIAN AGRICULTURAL PLANNING [AUTOMATISIERTE KARTOGRAPHIE IN DER BAYERISCHEN AGRARLEITPLANUNG]

Richard Hoisl In its Rept. on Mapping and Topographic Meas. 1977 p 39-51 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A06/MF A01

03 GEODESY AND CARTOGRAPHY

The Agricultural Administration of Bavaria, an administration without cartographic tradition, handles new planning tasks by applying automated graphic data processing in connection with an existing information system. The arising cartographic tasks, their problems and solutions by means of automation are described. Author (ESA)

N78-20584# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

EDP SUPPORTED REALIZATION OF DISPLACEMENT PROCESSES IN THE CARTOGRAPHIC GENERALIZATION OF TOPOGRAPHIC MAPS [EDV-UNTERSTUETZTE DURCHFUEHRUNG VON VERDRAENGUNGSPROZESSEN BEI DER KARTOGRAPHISCHEN GENERALISIERUNG IN TOPOGRAPHISCHEN KARTEN]

Werner Lichtner *In its Rept. on Mapping and Topographic Meas.* 1977 p 65-75 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A06/MF A01

A thoroughly tested model for the automatic performance of displacements in batch mode, where the displacement is controlled by linear operator is described. The suitability of different operators and the necessary dimensioning of the model are shortly discussed. Figures, showing the plotter drawings, demonstrate the suitability of the proposed algorithms for the standard cases of displacement as well as for special cases. Author (ESA)

N78-20589# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

SOME CARTOGRAPHIC APPLICATIONS OF DIGITAL IMAGE PROCESSING [EINIGE KARTOGRAPHISCHE ANWENDUNGEN DER DIGITALEN BILDVERARBEITUNG]

Wigand Weber *In its Rept. on Mapping and Topographic Meas.* 1977 p 103-122 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A06/MF A01

Some examples of techniques for digital image processing to be used for problems in computer-aided cartography are presented. These are: production of multi-line symbols from skeleton lines, the conformal transformation, the interactive erasure of a line part, the coding of meshes, edges, and nodes of a planar graph, and the determination of classes of terrain slopes from maps with equidistant contour lines. It is demonstrated how these complex operations can be reduced to a few macros only (i.e. thickening, propagation, calculation of the distance transform, and convolution); these macros again are to be composed of a few primitive image operations. The problems related to the large data quantities and high computing times are also dealt with. Author (ESA)

N78-21507* National Aeronautics and Space Administration, Washington, D. C.

HCMM SATELLITE TO TAKE EARTH'S TEMPERATURE

20 Apr. 1978 42 p

(NASA-News-Release-78-60; P78-10057) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The heat capacity mapping mission (HCMM), a low cost modular spacecraft built for the Applications Explorer Missions (AEM), was designed to allow scientists to determine the feasibility of using day/night thermal infrared remote sensor-derived data to: (1) discriminate various rock types and locate mineral resources; (2) measure and monitor surface soil moisture changes; (3) measure plant canopy temperatures at frequent intervals to determine transpiration of water and plant stress; and (4) measure urban heat islands. The design of the spacecraft (AEM-A), its payload, launch vehicle, orbit, and data collection and processing methods are described. Projects in which the HCMM data will be applied by 12 American and 12 foreign investigators are summarized. A.R.H.

N78-21578# SRI International Corp., Menlo Park, Calif.
INTERACTIVE AIDS FOR CARTOGRAPHY AND PHOTO INTERPRETATION Semiannual Technical Report, 12 May - 11 Nov. 1977

Harry G. Barrow Dec. 1977 53 p refs

(Contract DAAG29-76-C-0057; ARPA Order 2894)

(AD-A049768) Avail: NTIS HC A04/MF A01 CSCL 14/5

The ARPA Image Understanding Project at SRI has the scientific goal of investigating and developing ways in which diverse sources of knowledge may be used to interpret images automatically. The research is focused on the specific problems entailed in interpreting aerial photographs for cartographic and intelligence purposes. A key concept is the use of a generalized digital map to guide the process of image interpretation. In the past six months, the components developed under this project have been integrated into a single system, known as Hawkeye. The system includes modules for handling a large knowledge base in the form of a semantic net and terrain data files for using a raster-scan display and graphics tablets, for running task-specific subsystems, and for communicating with the user via graphics and in English. GRA

GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

A78-24799 * Trace elements in ocean ridge basalts. R. W. Kay (California, University, Los Angeles, Calif.) and N. J. Hubbard (NASA, Johnson Space Center, Houston, Tex.). *Earth and Planetary Science Letters*, vol. 38, no. 1, Feb. 1, 1978, p. 95-116. 177 refs. NSF Grants No. GA-16457; No. DES-74-20945.

A study is made of the trace elements found in ocean ridge basalts. General assumptions regarding melting behavior, trace element fractionation, and alteration effects are presented. Data on the trace elements are grouped according to refractory lithophile elements, refractory siderophile elements, and volatile metals. Variations in ocean ridge basalt chemistry are noted both for regional and temporal characteristics. Ocean ridge basalts are compared to other terrestrial basalts, such as those having La/Yb ratios greater than those of chondrites, and those having La/Yb ratios less than those of chondrites. It is found that (1) as compared to solar or chondrite ratios, ocean ridge basalts have low ratios of large, highly-charged elements to smaller less highly-charged elements, (2) ocean ridge basalts exhibit low ratios of volatile to nonvolatile elements, and (3) the transition metals Cr through Zn in ocean ridge basalts are not fractionated more than a factor of 2 or 3 from the chondritic abundance ratios. S.C.S.

A78-25652 GEOSAT - Geological industry recommendations on remote sensing from space. F. B. Henderson, III (GEOSAT Committee, Inc., San Francisco, Calif.) and R. J. Ondrejka (Itek Corp., Lexington, Mass.). (*International Congress for Photogrammetry, 13th, Helsinki, Finland, July 1976.*) *Photogrammetric Engineering and Remote Sensing*, vol. 44, Feb. 1978, p. 165-169.

A review is presented of applications of remote sensing to geological studies such as for monitoring oil, gas, geothermal, and mineral resources, and for engineering and environmental geology. Several recommendations are proposed including: (1) further development of geologically-centered satellite missions, (2) initiation of satellite projects such as stereoscopic coverage, improved resolution, additional spectral bands, thermal IR, radar, and color photography, (3) implementation of Landsat and Stereosat capabilities, and (4) the establishment of a permanent, nongovernment Geosat Committee. S.C.S.

A78-27732 * The crystallisation trends of spinels in tertiary basalts from Rhum and Muck and their petrogenetic significance. W. I. Ridley (Lamont-Doherty Geological Observatory; Columbia University, Palisades, N.Y.). *Contributions to Mineralogy and Petrology*, vol. 64, 1977, p. 243-255. 14 refs. Grant No. NGR-33-008-199.

Spinel found in transitional olivine basalts from the Islands of Rhum and Muck in the British Tertiary Province are analyzed to determine their chemical variability and their relationship to silicate phases. Chemical zoning of the cores of spinels which spilled into the basaltic liquid may be due to a reaction between the spinel and the liquid resulting in more Fe- and Ti-rich spinels. In addition, a peritectic-type reaction seems to have occurred, causing the transformation of aluminum spinel to chrome spinel with precipitation of plagioclase. Changes in the basaltic liquid are reflected by these transformations in the spinel composition. J.M.B.

A78-27733 * Mapping of hydrothermal alteration in the Cuprite mining district, Nevada, using aircraft scanner images for the spectral region 0.46 to 2.36 microns. M. J. Abrams, A. F. H. Goetz, A. B. Kahle (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), R. P. Ashley (U.S. Geological Survey, Menlo Park, Calif.), and L. C. Rowan (U.S. Geological Survey, Reston, Va.). *Geology*, vol. 5, Dec. 1977, p. 713-718. 9 refs. Contract No. NAS7-100.

A78-27765 Application of LANDSAT imagery to studies of structural geology and geomorphology of the Mentese region of southwestern Turkey. I. Kaya (Ankara University, Ankara, Turkey) and V. Klemas (Delaware, University, Newark, Del.). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 51-60. 6 refs.

Landsat-1 multispectral scanner band 5 and band 7 images have been visually interpreted to prepare geologic, tectonic and geomorphologic maps of the Mentese region of southwestern Turkey. Band 7 was most valuable for identifying geologic formations, tectonic fault lines and geomorphologic slope contrast. Band 5 supplemented the information obtained from band 7, by providing information on rock-soil boundaries, tectonic relationships between vegetation and structure, and vegetational tonal differences between steep slopes and flat surfaces. (Author)

A78-28247 # Remote-sensing methods for monitoring surface coal mining in the northern Great Plains. N. Mamula, Jr. (Pennsylvania State University, University Park, Pa.). *U.S. Geological Survey, Journal of Research*, vol. 6, Mar.-Apr. 1978, p. 149-160. 12 refs.

Recent studies at a large surface coal mine in southern Montana confirm that remote sensing is both feasible and effective for gathering land-use and environmental data for large-scale surface mines in the northern Great Plains. A mine near Colstrip, Mont., was selected as a test site because it typifies surface operations in the Powder River Basin of Montana and Wyoming and elsewhere in the northern Great Plains. Several basic interpretive and analytical remote-sensing techniques were used to identify and delineate various categories of surface-mining operations and concurrent stages of reclamation that characterize most, if not all, such mining operations. Color infrared and black-and-white aerial photographs and a black-and-white band 5 Landsat image were used to identify (1) highwall and bench areas, (2) ungraded spoils, (3) graded and recontoured areas, (4) revegetated recontoured areas, (5) natural and impounded surface water, and (6) miscellaneous areas. Over the lifespan of an extensive surface mine, cultural and natural processes and cumulative environmental effects can be monitored by capitalizing on the close correlation between enhanced satellite imagery, infrared and (or) black-and-white aerial photography, standard large-scale topographic maps, and results of on-site inspection of mining and reclamation. (Author)

A78-28271 Environmental assessment of the fluidized-bed combustion of coal - Methodology and initial results. K. S. Murthy, H. Nack (Battelle Columbus Laboratories, Columbus, Ohio), and D. B. Henschel (U.S. Environmental Protection Agency, Industrial Environmental Research Laboratory, Research Triangle Park, N.C.). *Air Pollution Control Association, Journal*, vol. 28, Mar. 1978, p. 213-220. 9 refs. U.S. Environmental Protection Agency Contract No. 68-02-2138.

A78-28383 The contributing role of scale in remote sensing for structural geology (Rôle de l'échelle dans l'apport de la télédétection en géologie structurale). J.-M. Brosse and J.-Y. Scanvic (Bureau de Recherches Géologiques et Minières, Orléans, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 99-117. 7 refs. In French.

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An analysis of imagery with scales ranging from 1:1,000,000 to as low as 1:20,000 permits identification of lineaments suggesting an annular geological formation situated entirely in granite. The analysis, applied to the Villefranche-de-Rouergue zone of France, employs data from Landsat-1, as well as Skylab, aircraft and balloon observations. The detection of fractures and sills is discussed in terms of the spatial and spectral resolution of the sensors, the films used, and the time and season of data acquisition. No geological explanation is offered for the annular formation. J.M.B.

A78-28391 Research on the thermal behavior of a sill and on the conditions for applying thermal remote sensing to mining research (*Recherches sur le comportement thermique d'un filon et sur les conditions d'application à la télédétection thermique en recherche minière*). J.-M. Brosse (Bureau de Recherches Géologiques et Minières, Orléans, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 235-248. 6 refs. In French.

Nocturnal thermal imagery has been adopted for the remote detection of a quartz vein concealed under soil and vegetation. An automatic in situ monitoring system provided data on thermal changes in schists and quartz veins; the maximum variation in temperature between the mineral and the surroundings was found to be 10 C, a differential which should be sensible to detection under certain conditions of coverage. J.M.B.

A78-28397 Some aspects of using balloon photographs in geology (*Quelques exemples d'utilisation des photographies-ballon en géologie*). G. Weecksteen (Bureau de Recherches Géologiques et Minières, Orléans, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 377-380. In French.

Various applications of photographs taken by stratospheric balloons are identified, including: (1) regional studies of morphology and its geological significance, (2) the study of fracturation which often controls the hydrographic profile, and (3) the mapping of surface formations and lithostratigraphic units. The photographs are considered an intermediate stage between satellite and aircraft observations. S.C.S.

A78-29827 Land use and land cover map and data compilation in the U.S. Geological Survey. J. R. Anderson (U.S. Geological Survey, Reston, Va.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.

Falls Church, Va., American Society of Photogrammetry, 1977, p. 2-12. 8 refs.

USGS projects include experimentation with and demonstration of land use and land cover mapping at scales of 1:24,000 and 1:50,000, and research to determine the possible uses of Landsat data in association with higher resolution source materials for Level II land use and land cover mapping requirements. Products include maps showing political units, magnetic tapes containing digital data obtained by digitizing in polygon format the land use and land cover maps, and land use and land cover statistics. Remote sensor data requirements, organization and presentation of data, and updating requirements are discussed. M.L.

A78-29845 Remote sensing techniques for monitoring impacts of phosphate mining in Southeastern Idaho. D. M. Carnegie (U.S. Geological Survey, Earth Resources Observation Systems Data Center, Sioux Falls, S. Dak.) and C. S. Holm (South Dakota State University, Brookings, S. Dak.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.

Falls Church, Va., American Society of Photogrammetry, 1977, p. 251-272.

Both manual and automated analysis of high-altitude aircraft and Landsat data have been applied to the assessment of the environmental impact of a phosphate strip mining operation in Southeastern Idaho. Vegetation coverage maps were produced through digital analysis of Landsat computer compatible tapes; digital ratioing permitted monitoring of biological and physical changes. Mine characteristics and activities, as well as certain wildlife habitats particularly sensitive to mining activities, could be detected through manual analysis of the high-altitude color infrared photographs. J.M.B.

A78-30233 # The land use and land cover map and data program of the U.S. Geological Survey - An overview. J. L. Place (U.S. Geological Survey, Reston, Va.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 1-9.

The U.S. Geological Survey sponsors a land use and land cover mapping and data distribution program which produces primarily 1:250,000 and 1:100,000 scale maps. The maps, as well as magnetic tapes containing the land use and land cover data in digitized form, are available for states and counties, drainage areas, census tracts, coastal regions, and certain metropolitan areas. Landsat data and aerial reconnaissance imagery from NASA aircraft have been used to develop the land use maps; special projects within the program have included the analysis of Skylab thermal scanner imagery of an urban heat island (Baltimore, Maryland). J.M.B.

A78-30292 Remote sensing of buried resistive inhomogeneities by electromagnetic transmission measurements between the ground surface and a borehole - Theory and experiment. M. Cauterman, P. Degauque, B. Demoulin, and R. Gabillard (Lille I, Université, Lille, France). *Radio Science*, vol. 13, Mar-Apr. 1978, p. 371-378. 14 refs. Research supported by the Ministère des Travaux Publics.

A theoretical solution for the electromagnetic response of a three-dimensional inhomogeneity in a conductive half space has been developed for horizontal electric dipole excitation. We assume that the transmitting frequency is sufficiently low that we may use the quasi-static approximation. The solution for the subsurface electric field is obtained in the form of an integral equation system which is reduced to a matrix equation and solved numerically. This theoretical model is applied to determine the feasibility of remote sensing of underground quarries by transmission measurements between the ground surface and a borehole. The first experimental results are also given and they show that it is possible to find a cavity (of about 100 cu m) situated at a depth of 15 m and at a distance of 5 m from the drillhole. (Author)

A78-30293 The transient fields of simple radiators from the point of view of remote sensing of the ground subsurface. A. Z. Botros and S. F. Mahmoud (Cairo, University, Giza, Egypt). *Radio Science*, vol. 13, Mar-Apr. 1978, p. 379-389. 11 refs. Grant No. NOAA-04-6-158-44034.

The electromagnetic transient response of electric line sources and current-carrying loops above a two-layered stratified ground is considered at both early and late times. The early time fields are obtained using the geometrical ray theory, while the late time fields are treated in a manner following the work of Wait, leading to closed-form solutions. The limiting case of a homogeneous ground is considered by more exact means and comparisons are made with the case of late time response of the layered ground model. It is shown that the depth and the conductivity of the overburden layer may be detected from the behavior of the transient fields. (Author)

A78-30294 Scattering of electromagnetic waves by a perfectly conducting half plane below a stratified overburden. O. Olsson (Lulea, University, Lulea, Sweden). *Radio Science*, vol. 13, Mar-Apr. 1978, p. 391-397. 10 refs. Research supported by the Styrelsen for Teknisk Utveckling.

By expanding the electromagnetic field into plane wave eigenfunctions, an integral equation is obtained which describes the

coupling between an overburden, consisting of an arbitrary number of plane layers and an arbitrary object beneath a stratified half space. As an example of the technique, a perfectly conducting half plane inclined to the strata in a substratum is discussed. In this case the kernel of the integral equation may be expressed in terms of elementary functions. Numerical results are discussed for a plane wave incident on the ground. (Author)

A78-30800 # Geological manifestation of crustal stresses in the Don-Dnieper trough as disclosed in the interpretation of spaceborne photographs (Geologichnii proiav naprug u zemnii kori Dono-Dniprov's'kogo proginu za rezul'tatami deshifruvannia kosmich-nikh znimkiv). G. Ia. Golizdra (Dnipropetrovskii Gornichii Institut, Dnepropetrovsk, Ukrainian SSR). *Akademiia Nauk Ukrain's'koi RSR, Dopovid, Seriia B - Geologichni, Khimichni ta Biologichni Nauki*, Jan. 1978, p. 7-10. 9 refs. In Ukrainian.

Satellite-borne photographs have disclosed a longitudinal system of tectonic faults in the Don-Dnieper trough. The asymmetry of the system is associated with the action of horizontal stresses in the crust directed from the south and southwest and centered in the Don Basin. The tectonic forces are thought to be quite recent. B.J.

N78-16402 George Washington Univ., Washington, D. C. **LITHOLOGY MAPPING OF CRYSTALLINE SHIELD TEST SITES IN WESTERN SAUDI ARABIA USING COMPUTER-MANIPULATED MULTISPECTRAL SATELLITE DATA** Ph.D. Thesis

Herbert William Blodget 1977 223 p
Avail: Univ. Microfilm Order No. 77-23810

Two areas were selected in the Arabian Shield to provide ideal test sites for the evaluation of satellite remote sensing capabilities for geological mapping: emphasis was placed on rock discrimination using LANDSAT multispectral scanner data. The Sahl al Matran area of northwestern Saudi Arabia was selected as the primary test site for evaluating a wide range of optical-electrical (analog) and computer (digital) classification and enhancement techniques. Two interactive, digital, multispectral classification systems were tested that respectively employed the Bayesian maximum-likelihood and parallelepiped classification algorithms. A variety of computer enhancement techniques were evaluated. Dissert. Abstr.

N78-16405 Oregon State Univ., Corvallis. **REMOTE SENSING APPLICATIONS IN HYDRO-GEOTHERMAL EXPLORATION OF THE NORTHERN BASIN AND RANGE PROVINCE** Ph.D. Thesis

Thomas William Holder 1977 235 p
Avail: Univ. Microfilms Order No. 77-29413

An evaluation was conducted utilizing side-looking-airborne-radar (SLAR) and thermal infrared (TIR) detectors in a complementary fashion. The program consisted of preliminary overflights of SLAR for the detection of fault lineaments along which surface expressions of hydro-geothermal activity are localized. Interpretation of the SLAR imagery was used to generate TIR flightlines corresponding to the major lineaments. Subsequent flights incorporated TIR line scanners utilizing the mercury-cadmium-telluride, indium antimonide, and indium arsenide detectors. A map was produced depicting the interpreted data. The map graphically portrays the structural relationship between the interpreted surface hydro-geothermal sites and the fracture traces, at a scale of 1:500,000. Dissert. Abstr.

N78-18601 Michigan Univ., Ann Arbor. **THE GEOLOGY OF THE GREAT LAKES ICE COVER** Ph.D. Thesis

Ernest Willard Marshall 1977 643 p
Avail: Univ. Microfilms Order No. 77-26298

Geological processes and features of the Great Lakes coastal zone during winter and spring were examined in detail and

extensively illustrated by ground and aerial photographs. There were 39 geological, ice-forming regions identified on the Great Lakes and in the connecting lakes, straits and rivers. The patterns of ice land formation on the Great Lakes in mild, normal, and severe winters are illustrated by ice charts. The areas of icelands formed on the Great Lakes and in the shorelands are presented by lake, by state or province. Finally, the significance of Great Lakes icelands to resource management is discussed by viewing their impact on the following five areas of public concern: public health, winter recreation, shorelines, winter shipping, and jurisdiction. Included within the appendices were sections on methods and techniques for lake ice investigations as well as a short history of the Great Lakes ice cover resource.

Dissert. Abstr.

N78-19560* # Geological Survey, Denver, Colo. **GEOLOGICAL APPLICATIONS OF THERMAL-INERTIA MAPPING FROM SATELLITE** Progress Report, 1 Dec. 1977 - 28 Feb. 1978

Terry W. Offield, Principal Investigator and S. H. Miller 1 Mar. 1978 19 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (E78-10081; NASA-CR-155759) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. A more efficient algorithm for calculating surface temperature was developed. This algorithm was determined to be essentially exact, and relative accuracies in determining thermal inertia of the finite difference and the linear Fourier series algorithms were approximately 5% for both. A procedure for performing geometric registration was developed.

N78-19584* # Dartmouth Coll., Hanover, N.H. **AN INVESTIGATION OF AGRICULTURAL AND OTHER EARTH RESOURCE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. A: LANDSAT. B: REMOTE SENSING OF VOLCANIC EMISSIONS** Semiannual Status Report, 1 Jul. - 31 Dec. 1977

Robert E. Huke, Vincent M. Malmstrom, Charles L. Drake, Robert C. Reynolds, Richard W. Birnie, and Richard E. Stoiber, Principal Investigators 31 Dec. 1977 43 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (Grant NSG-5014) (E78-10085; NASA-CR-155763) Avail: NTIS HC A03/MF A01 CSCL 02C

N78-19570* # Stanford Univ., Calif. Remote Sensing Lab. **GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A: HEAT CAPACITY MAPPING MISSION** Progress Report, 1 Dec. 1977 - 28 Feb. 1978

R. J. P. Lyon and A. E. Prelat, Principal Investigators 28 Feb. 1978 10 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (Contract NAS5-24232) (E78-10092; NASA-CR-155773) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Analysis of local areas by point-to-point registration was achieved.

N78-19574* # Geological Survey, Reston, Va. **SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND** Final Report, 15 Jan. 1973 - 15 Aug. 1974

Richard S. Williams, Jr., Principal Investigator 1 Jan. 1978 109 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

04 GEOLOGY AND MINERAL RESOURCES

(NASA Order S-70243-AG)

(E78-10096; NASA-CR-155787)
HC A08/MF A01 CSCL 08F

Avail: NTIS

The author has identified the following significant results. The ERTS imagery has sufficient resolution to map, from MSS color composites, areas of altered ground caused by high temperature geothermal activity at the Namafjall, Torfajokull, and Reykjanes geothermal areas. The major axes of the fallout pattern of tephra from the May - July 1970 volcanic eruption from Hekla Volcano can be mapped where sufficient depth of deposition was present to seriously affect the normal vegetation. Lava flows from the 1961 volcanic eruption at Askja; some of the lava flows from the 1947-48 eruption, and all of the lava flows from the 1970 eruption at Hekla; and the areas covered by tephra and lava from the 1973 eruption on Heimaey could be delineated. Low sun angle imagery of less than 10 deg of snow covered terrain was particularly valuable in mapping structural and volcanic features concealed beneath glacial ice in the active volcanic zones of Iceland.

N78-19582* National Aeronautics and Space Administration, Washington, D. C.

BACKGROUND AND PRINCIPLE APPLICATIONS OF REMOTE SENSING IN MEXICO

Jose Armando Diez Perez Mar. 1978 13 p Transl. into ENGLISH of conf. paper on "Antecedentes y Principales Aplicaciones de la Percepcion Remota en Mexico" Presented at the UN/FAO Regional Training Seminar on the Appl. of Satellite Remote Sensing, La Paz, Bolivia, 1-9 Dec. 1977 p 1-14 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-2791)

(NASA-TM-75091) Avail: NTIS HC A02/MF A01 CSCL 08F

Remote sensing, or the collection of information from objectives at a distance, crystallizes the interest in implementing techniques which assist in the search for solutions to the problems raised by the detection, exploitation, and conservation of the natural resources of the earth. An attempt is made to present an overview of the studies and achievements which have been obtained with remote sensing in Mexico. Author

N78-21510* Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

STUDY OF SOFT ALKALINE USING LANDSAT IMAGES OF POOLS AND RESIDUE WITH AN EMPHASIS ON RADIOACTIVE MATERIALS [ESTUDO DO MACICO ALCALINO DE POCOS DE CALDAS ATRAVES DE IMAGENS LANDSAT COM ENFASE EM MINERALIZACOES RADIOATIVAS]

Raimundo Almeida Filho, Principal Investigator and Waldir Renato Paradella Sep. 1977 138 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(E78-10104; NASA-CR-156156; INPE-1112-TPT/065) Avail: NTIS HC A08/MF A01 CSCL 05A

N78-21514* Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

REMOTE SENSING APPLIED TO GEOLOGICAL MAPPING; COMPARATIVE GEOMORPHOLOGY AND IDENTIFICATION OF MINERAL ZONES OF ZINC AND LEAD IN THE REGION OF VAZANTE, MG [SENSORIAMENTO REMOTO APLICADO A MAPEAMENTO GEOLOGICO, COMPARTIMENTACAO GEOMORFOLOGICA E IDENTIFICACAO DE ZONA MINERALIZADA EM ZINCO E CHUMBO NA REGIAO DE VAZANTE, MG]

Flavio Soares do Nascimento, Principal Investigator and Maria Amelia Leite Soares do Nascimento Nov. 1977 151 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(E78-10108; NASA-CR-156125; INPE-1157-TPT/072) Avail: NTIS HC A08/MF A01 CSCL 08G

The author has identified the following significant results. Results showed that the black and white aerial photographs and the color infrared transparencies were efficient for mapping of three lithological units of the Paraopeba formation and for mineralized zones identification, respectively. Multispectral transparencies of I2S made it easier to separate dolomites, which were the rocks conditioning zinc and lead mineralization. Statistical analysis of morphometric indexes obtained from black and white photographs and topographic charts showed significant difference among three lithological units of Paraopeba formation which can be defined as Crest, Hilly, and Karstic reliefs.

N78-21523* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jan. - Mar. 1978**

Anne B. Kahle, Principal Investigator and Helen N. Paley Apr. 1978 4 p ERTS

(Contract NAS7-100)

(E78-10119; NASA-CR-156086)

Avail: NTIS

HC A02/MF A01 CSCL 08G

N78-21530* Geological Survey, Reston, Va.

ACTIVITIES OF THE US GEOLOGICAL SURVEY IN APPLICATIONS OF REMOTE SENSING IN THE CHESAPEAKE BAY REGION

James R. Wray In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 25-26

Avail: NTIS HC A17/MF A01 CSCL 08J

The application of remote sensing in the Chesapeake Bay region has been a central concern of three project activities of the U.S. Geological Survey: two are developmental, and one is operational. The two developmental activities were experiments in land-use and land-cover inventory and change detection using remotely sensed data from aircraft and from the LANDSAT and Skylab satellites. One of these is CARETS (Central Atlantic Regional Ecological Test Site). The other developmental task is the Census Cities Experiment in Urban Change Detection. The present major concern is an operational land-use and land-cover data-analysis program, including a supporting geographical information system. Author

N78-21533* Maryland Geological Survey, Baltimore.

REMOTE SENSING, GEOLOGY, AND LAND USE

Kenneth N. Weaver In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 37-43 refs

Avail: NTIS HC A17/MF A01 CSCL 08G

The usefulness of a geologic map as a product in geological research was discussed, and the evolution of the geologic map of Maryland was illustrated. Remote sensing methods that have the most immediate application to the earth science aspects of the Chesapeake Bay region are listed. B.B.

OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

these fluxes are compared with estimates obtained from spectra of velocity, temperature and humidity fluctuations with the use of the inertial dissipation technique. Directly measured momentum and moisture flux values are in reasonable agreement with inertial dissipation values. The sensible heat flux obtained by the inertial dissipation technique is about twice as large as the directly measured heat flux. The dependence on wind speed of bulk transfer coefficients of momentum, heat and moisture and of variances of velocity and scalar fluctuations is discussed and compared with available data. (Author)

A78-25871 # Models and measurements of UHF multipath in a marine environment. K. R. Carver. In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 431-436. 21 refs.

UHF forward scatter and multipath measurements were conducted to obtain a basis for a prediction model which will provide designers of a marine environmental data system with estimates of the fading range and the statistical distribution parameters that could be used to reduce or eliminate fluctuations. The considered system is concerned with the telecommunication of the data from points in the world's oceans via satellite to central land-based data acquisition stations. It is shown both from the measurements and from theoretical considerations that coherent multipath fluctuations can result from both interference lobes and gravity-wave tilt and height modulation of those lobes. Simple formulas are presented to aid in the estimation of the total coherent fading range. G.R.

A78-25898 # Remote sensing of gravity - Capillary ocean wave interactions using a dual-frequency radar. D. L. Schuler and W. J. Plant (U.S. Navy, Naval Research Laboratory, Washington, D.C.). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 585-590. 5 refs.

Experiments were carried out on a cliff site above Chesapeake Bay; two dual-frequency radars were tested in terms of their suitability for detecting interaction between capillary and gravity ocean wave systems; (1) a CW 10 W X-band radar and (2) a pulsed 5 KW L band radar. The dual-frequency radar technique has the capability of measuring: (1) the gravity wave dispersion relation for deep and shallow water, (2) directional gravity wave modulation spectra, (3) ocean surface currents, and (4) two-scale wave-wave interactions. The system is small enough to be mounted on an aircraft for use as a research tool or as a means for ocean surveillance of wave systems. B.J.

A78-26050 Inversion of second-order radar echoes from the sea. B. Lipa (Stanford University, Stanford, Calif.). *Journal of Geophysical Research*, vol. 83 Feb. 20, 1978, p. 959-962. 10 refs. Contracts No. N00014-76-C-0356; No. NOAA-03-6-022-35260.

The Doppler spectrum of high-frequency radar echoes from the sea consists of dominant peaks due to first-order Bragg scatter surrounded by a higher-order continuum. Most applications to date have been based on the first-order lines, requiring multiple observations and large or moving antennas. In contrast, inversion of the second-order structure can yield the complete directional ocean wave spectrum from a single radar observation. In this report we describe the first inversion of measured second-order echo spectra from a 21.75-MHz narrow-beam radar looking in a single direction. Estimates of the directional ocean wave spectrum are compared with surface truth provided by tilt buoy and weather station, and fair agreement is found. This initial success is indicative of the potential of this technique for remote sensing of the sea surface. (Author)

A78-21343 Monitoring river ice break-up from space. D. F. McGinnis, Jr. and S. R. Schneider (NOAA, National Environmental Satellite Service, Washington, D.C.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Jan. 1978, p. 57-68. 13 refs.

Images from operational environmental satellites provide an effective means to assess formation and dissipation of river ice. The National Environmental Satellite Service (NESS) receives images daily from polar-orbiting NOAA satellites and every 30 minutes during daylight from NOAA geostationary satellites. During the period April 4-14, 1976, fourteen ice-covered reaches on the Ottawa River were monitored daily by using satellite imagery. The ice-covered reaches were observed to break up in place; at the end of the 10-day study period only three of the original 14 remained. Satellite views of the river permitted the measurement of changes in the length of the individual ice-covered reaches. High-resolution imagery from NASA's Landsat satellites as well as digital tape data from the NOAA polar-orbiting satellites were used to calibrate the measurements. (Author)

A78-24541 Radar detection of oil spills on the surface of the sea. Iu. M. Galaev, A. I. Kalmykov, A. S. Kurekin, Iu. A. Lementa, B. A. Nelepo, I. E. Ostrovskii, A. P. Pichugin, V. V. Pustovoitenko, and Iu. V. Terekhin (Akademiia Nauk Ukrainskoi SSR, Institut Radiofiziki i Elektroniki, Kharkov; Akademiia Nauk Ukrainskoi SSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR). (*Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana*, vol. 13, Apr. 1977, p. 406-414.) *Academy of Sciences, USSR, Izvestiya, Atmospheric and Oceanic Physics*, vol. 13, Nov. 1977, p. 284-289. 12 refs. Translation.

A78-24646 # A cold temperature oceanic skin layer (O kholodnom temperaturnom skin-sloe okeana). Iu. M. Kuftarkov, B. A. Nelepo, and A. D. Fedorovskii (Akademiia Nauk Ukrainskoi SSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR). *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana*, vol. 14, Jan. 1978, p. 88-93. 10 refs. In Russian.

The use of satellite infrared photographs for studying processes in the quasi-isothermal layer of the ocean is discussed. A simple hydrodynamic model of the cold skin-layer is proposed, and the model is used to study the effect of cloudiness on skin-layer thermal parameters and to interpret two experiments. Patterns of time-dependent changes in the thermal parameters of a cold skin-layer during cloudiness variations are presented. M.L.

A78-25244 Measurements of turbulent fluxes in Bass Strait. R. A. Antonia, A. J. Chambers, S. Rajagopalan, K. R. Sreenivasan (Newcastle, University, Newcastle, Australia), and C. A. Friehe (California, University, La Jolla, Calif.). *Journal of Physical Oceanography*, vol. 8, Jan. 1978, p. 28-37. 23 refs. Research supported by the Australian Research Grants Committee and Internal Research Assessment Committee.

Measurements of turbulent momentum, heat and moisture fluxes have been made in Bass Strait from a stable platform, at a height of approximately 5 m above water. Direct measurements of

05 OCEANOGRAPHY AND MARINE RESOURCES

A78-26815 # Density field of the ocean waters (Pole plot-nosti vody mirovogo okeana). V. N. Stepanov (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR). *Okeanologiya*, vol. 17, Sept.-Oct. 1977, p. 778-783. 5 refs. In Russian.

In the present study, extensive averaged thermohaline data from the complete network of oceanographic stations were used to construct charts of the water density distribution in the oceans. The charts are obtained for the ocean surface and for depths of 200 m, 1000 m, and 4000 m. Some characteristics of the density field are discussed. V.P.

A78-27764 A theory of wave scatter from an inhomogeneous medium with a slightly rough boundary and its application to sea ice. S. K. Parashar, A. K. Fung, and R. K. Moore (Kansas, University, Lawrence, Kan.). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 37-50. 12 refs.

A theoretical model of electromagnetic wave scattering from an inhomogeneous medium with a slightly rough surface is employed to describe the backscatter from sea ice. In addition to accounting for small-scale roughness of the ice, the model is capable of taking into consideration the average variation in dielectric properties with vertical position inside the ice, as well as horizontal small-scale inhomogeneities within the volume. The model calculations agree in general with experimental observations conducted over the Arctic Ocean in 1970 by NASA Earth Resources Program aircraft using scatterometers at 0.4 GHz and 13.3 GHz, and an imaging radar at 16.5 GHz. J.M.B.

A78-28393 The utilization of time-lapse thermograms for current studies in surface waters - The example of the Languedoc coast (L'exploitation des thermographies chronoséquentielles pour l'étude courantologique des eaux superficielles - Exemple du littoral Languedocien). C. Armangau, R. Burkhalter (Centre d'Etudes et de Recherches Géologiques et Hydrologiques; Centre d'Etudes et de Recherches Géodynamiques et Astronomiques, Montpellier, France), and P. Olivon (Centre d'Etudes et de Recherches Géologiques et Hydrologiques; Centre d'Etudes et de Recherches Géodynamiques et Astronomiques, Montpellier; Ecole Pratique des Hautes Etudes, Paris, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 257-304. In French.

A78-28405 The 1975 Bouches-du-Rhône experiment: The interpretation of marine and coastal phenomena of the Fos au Grau du Roi - Particular application to the Golfe de Fos and the Rhone estuary (Expérience Bouches-du-Rhône 1975: Interprétation des phénomènes marins et littoraux de Fos au Grau du Roi - Application particulière au Golfe de Fos et au débouché du Rhône). M. L. Loubersac (Centre National pour l'Exploitation des Océans, Paris, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 541-596. In French.

A broad survey of the 1975 Bouches-du-Rhône experiment is presented. Particular attention is given to: (1) the dynamics of water masses, (2) littoral and near-littoral morphology, (3) atmospheric circulation, (4) precipitation, (5) hydrology, (6) the pattern of sea swells, (7) currents, (8) turbulence, (9) verification by sea truth. Various remote sensing techniques are evaluated and comparisons are made with other methods for oceanographic research. S.C.S.

A78-28935 * Focusing effects in the synthetic aperture radar imaging of ocean waves. A. Jain (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Applied Physics*, vol. 15, Mar. 1978, p. 323-333. 17 refs. Contract No. NAS7-100.

The paper derives the properties of the image obtained for an ocean wave whose cross section and surface profile are functions, representing the wave phenomena, whose exact properties are determined by the ocean wave surface properties, for ocean wavelength, height, and orbital frequency. The effect of defocusing of the wave image due to its temporal motion is calculated, and both the resolution of the radar system if no focus compensation is provided in the processor and the necessary distance the azimuth telescope has to be moved to provide diffraction-limited imaging are derived. These results are illustrated for data obtained by synthetic aperture radar during Hurricane Gloria on September 30, 1976, and by ERIM radar over Marineland, Florida, on December 15, 1975.

(Author)

A78-29521 * An investigation of the astronomical theory of the ice ages using a simple climate-ice sheet model. D. Pollard (California Institute of Technology, Pasadena, Calif.). *Nature*, vol. 272, Mar. 16, 1978, p. 233-235. 18 refs. Contract No. NAS5-22965.

The astronomical theory of the Quaternary ice ages is incorporated into a simple climate model for global weather; important features of the model include the albedo feedback, topography and dynamics of the ice sheets. For various parameterizations of the orbital elements, the model yields realistic assessments of the northern ice sheet. Lack of a land-sea heat capacity contrast represents one of the chief difficulties of the model. J.M.B.

A78-29834 * Seasat-A data acquisition and distribution. J. A. Dunne (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 71-84. 26 refs. Contract No. NAS7-100.

The instrument package of the Seasat-A satellite, scheduled for launch in 1978, consists of a short-pulse radar altimeter, a wind field scatterometer, a scanning multichannel microwave radiometer, and an experimental L-band synthetic aperture radar. Objectives of the mission include precision altimetry for marine geoid and sea surface topography assessments, the determination of wave directional spectra through radar scatterometry, and sea surface temperature measurements through microwave emission analysis. The synthetic aperture radar, operated selectively, is intended to yield land and sea imagery with a resolution of 25 m for such requirements as coastal surveys. J.M.B.

A78-29843 Maximum likelihood classification of kelp resources (*Macrocystis pyrifera*) from Landsat computer compatible tapes. J. R. Jensen, L. R. Tinney, and J. E. Estes (California, University, Santa Barbara, Calif.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.

Falls Church, Va., American Society of Photogrammetry, 1977, p. 201-212. 17 refs.

Landsat digital data have been employed to estimate the areal extent of *Macrocystis pyrifera*, a kelp species important for algin production. Iterative maximum likelihood classifications prove capable of providing an accuracy greater than 92% in discriminating a kelp plantation from the ocean or land. Currents, tides and plantation densities must also be assessed to have a complete inventory of kelp resources. J.M.B.

A78-29850 Landsat goes to sea. J. C. Hammack (Defense Mapping Agency, Hydrographic Center, Washington, D.C.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 316-329. 16 refs.

The analysis of Landsat high-gain multispectral scanning imagery to improve the quantity, currency and accuracy of worldwide hydrographic survey data is discussed. In particular, the mapping of clear oceanic waters to depths required for safe navigation has proved possible with multispectral scanning green band data. Use of the Landsat data to survey islands, banks and reefs and to revise the positions of these formations on outdated charts may also be feasible. J.M.B.

A78-30286 On the origin of long-period features in low-angle sea backscatter. L. Wetzel (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Radio Science*, vol. 13, Mar.-Apr. 1978, p. 313-320. 21 refs.

Analysis of microwave sea backscatter at grazing angles less than one deg has provided evidence for features with periods of three to four minutes and 10 to 15 minutes. Among the explanations proposed for these long-period features are wave packets or interference patterns, shelf-waves, fluctuations in the surface wind field, and illumination thresholding at small grazing angles; in addition to these surface effects, propagation effects caused by refractivity perturbations or water vapor perturbations may also be needed to account for the phenomena. Wave-group effects on the surface and illumination thresholding appear to be the most important factors in explaining the long-period features. J.M.B.

A78-30287 Remote sensing of directional gravity wave spectra and surface currents using a microwave dual-frequency radar. D. L. Schuler (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Radio Science*, vol. 13, Mar.-Apr. 1978, p. 321-331. 9 refs. Navy-supported research.

A prototype dual-frequency coherent X-band radar and a pulsed dual-frequency L-band radar have been employed to measure the properties of wind-generated surface water waves. In particular, the modulation of centimeter and decimeter water waves by 2- to 18-m gravity waves was investigated. Through use of the dual-frequency radar technique, the gravity wave dispersion relation was obtained for deep and shallow water, and the directional gravity wave modulation spectra were determined. In addition, surface currents and certain two-scale wave interactions have been monitored. J.M.B.

A78-30311 Modulation of coherent microwave backscatter by shoaling waves. W. J. Plant, W. C. Keller, and J. W. Wright (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Journal of Geophysical Research*, vol. 83, Mar. 20, 1978, p. 1347-1352. 14 refs.

The orbital speed of long shoaling waves and the modulation of centimetric wind-generated waves by the shoaling waves were obtained from the frequency and amplitude modulations, respectively, of the backscattered signal of a coherent CW 9.375-GHz radar operated from the end of a pier on the Outer Banks of North Carolina. Modulations anomalously large in comparison with those predicted by the relaxation time model (Keller and Wright, 1975) were observed in the range of wind speeds 4.5-6.5 m/sec, which was perhaps coincidentally near the shallow water wave speed. Outside this range of wind speeds the model qualitatively accounted for the magnitude and wind speed dependence of the measured modulations. The phase of the modulation leads to the inference that the maximum amplitude of the short waves occurs near, and generally leeward of, the crests of long waves for wind speeds of up to 8 m/sec. (Author)

A78-30436 Microwave refractive index and absorption of initial forms of the sea ice cover and newly formed ice. V. V. Bogorodskii and G. P. Khokhlov (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Arkhticheskii i Antarkhticheskii Nauchno-Issledovatel'skii Institut, Leningrad, USSR). (*Zhurnal Tekhnicheskoi*

Fiziki, vol. 47, June 1977, p. 1294-1300.) *Soviet Physics - Technical Physics*, vol. 22, June 1977, p. 743-746. 7 refs. Translation.

A78-30437 Anisotropy of the microwave dielectric constant and absorption coefficient of Arctic drift ice. V. V. Bogorodskii and G. P. Khokhlov (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Arkhticheskii i Antarkhticheskii Nauchno-Issledovatel'skii Institut, Leningrad, USSR). (*Zhurnal Tekhnicheskoi Fiziki*, vol. 47, June 1977, p. 1301-1305.) *Soviet Physics - Technical Physics*, vol. 22, June 1977, p. 747-749. 8 refs. Translation.

A78-32391 Aerial color and color infrared survey of marine plant resources. A. Austin and R. Adams (Victoria, University, Victoria, British Columbia, Canada). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Apr. 1978, p. 469-480. 22 refs. Research supported by the Department of Fisheries and Forestry, National Research Council of Canada, and University of Victoria.

In the future, seaweed will become an important source of raw material for the extractives industry. Methods of mapping seaweed concentrations in the Georgia Strait in British Columbia are outlined, and correlated with a ground truth program. For submerged vegetation to a depth of 7 m, natural color photography was found to be most effective, while for surface and intertidal vegetation, natural color and color infrared techniques were best. The surveys were conducted by air and mapped on a scale of 1:10,000. A total of eleven vegetation units were classified, with attention to the red seaweed *Lridaea cordata*. D.M.W.

N78-16554# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.

SURFACE WIND MAPS FOR THE WESTERN INDIAN OCEAN FROM AUGUST 1975 TO OCTOBER 1976

Jose-Fernandez Partagas and Walter Duing Oct. 1977 88 p refs

(Contract N00014-75-C-0173)

(AD-A047305) Avail: NTIS HC A05/MF A01 CSCL 04/2

The interaction between ocean and atmosphere is particularly pronounced in the Arabian Sea and along its boundaries. The low-level atmospheric jet over East Africa and the Somali Current with its adjacent upwelling areas are prime examples of coupled air-sea phenomena. The large signals and the annual periodicity of these processes make them particularly attractive to the geophysical researchers, especially to oceanographers and meteorologists. As part of studying the influence of atmospheric motions on oceanic motions in the western Indian Ocean, maps describing the surface wind field for that area have been prepared at the University of Miami for a period of fourteen and a half months (mid-August 1975 to October 1976). The surface wind description given by these maps is more suitable for concurrent oceanographic studies than monthly mean winds obtained from climatological atlases: year-to-year variations and high horizontal resolution, which are averaged out in the atlas information, are retained on our maps. GRA

N78-16564# National Oceanic and Atmospheric Administration, Rockville, Md. Federal Coordinator for Marine Environmental Prediction.

FEDERAL PLAN FOR MARINE ENVIRONMENTAL PREDICTION, FISCAL YEAR 1977

Ralph E. Meguire, Jr., ed. May 1977 53 p (PB-273151/1; NOAA-77091301; NOAA-S/T-77-2609) Avail: NTIS HC A04/MF A01 CSCL 04B

This Federal Plan summarizes the Marine Environmental Prediction (MAREP) Program for the basic and specialized MAREP services. The basic MAREP Service provides for the acquisition, communication, and processing of data and dissemination of oceanic information including collection, transmission, and analysis of data and issuance of advisories, warnings, and forecasts. Specialized MAREP services draw upon the data output of the

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basic service. They provide support for maritime commerce, water quality assessment, living and nonliving marine resource programs, and national security. GRA

N78-17440* Stockholm Univ. (Sweden). Askö Lab.
DYNAMICS AND ENERGY FLOWS IN THE BALTIC ECOSYSTEMS: REMOTE SENSING Final Report
Bengt-Owe Jansson and Bo G. Nyqvist, Principal Investigators [1977] 173 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (E78-10067; NASA-CR-155567) Avail: NTIS HC A08/MF A01 CSCL 08F

N78-17640* Texas A&M Univ., College Station. Center for Marine Resources.
SCIENTIFIC INVESTIGATIONS IN THE GULF OF MEXICO AND CARIBBEAN SEA DURING THE 1974-1975 CALYPSO CRUISE, PARTS 1 AND 2 Final Report, Nov. 1974 - Dec. 1975

S. Z. ElSayed, H. Abdel Reheim, G. A. Fryxell, J. C. Harlan, J. M. Hill, P. Babai, and P. Whitney 31 Dec. 1975 262 p refs (Contract NAS5-20877) (NASA-CR-156688) Avail: NTIS HC A12/MF A01 CSCL 08J

The distribution and concentrations of the standing crop of phytoplankton and nutrient salts in the Gulf of Mexico and the Caribbean Sea were investigated to provide ground truth for correlating temperature and chlorophyll-a measurements with observations from NASA U-2 aircraft equipped with specially designed sensors for measuring ocean color phenomena. The physical, chemical, and biological data obtained are summarized. Sampling procedures and methods used for determining plant pigments, species composition of phytoplankton, nutrient salt analysis, and the euphotic zones are described. Author

N78-18665# Naval Oceanographic Office, Washington, D. C.
VARIABILITY OF OCEANOGRAPHIC CONDITIONS AT OCEAN WEATHER STATIONS IN THE NORTH ATLANTIC AND NORTH PACIFIC OCEANS

William H. Beatty, III Jun. 1977 89 p refs (AD-A048730; NOO-TN-3700-67-77) Avail: NTIS HC A05/MF A01 CSCL 08/11

Seasonal mean salinity, temperature, and sound velocity and their variability were determined for 12 ocean weather stations. Variability above 200m depths is caused by wind-induced mixing and upwelling, advection and radiational heating and cooling. Below 200m internal waves and ocean fronts cause the variability. Author (GRA)

N78-18668# Texas A&M Univ., College Station. Dept. of Oceanography.

OCEANOGRAPHIC STATION DATA COLLECTED ABOARD R/V MELVILLE DURING FDRAKE 75

W. D. Nowlin, T. Whitworth, III, L. E. Gordon, and G. C. Anderson May 1977 360 p (Grant NSF-ID074-14941-A01) (PB-274442/3; TAMU-REF-77-2-D; NSF/IDOE-77/161) Avail: NTIS HC A16/MF A01 CSCL 08J

During the months of January, February and March of 1975, three oceanographic research vessels participated in the First Dynamic Response and Kinematics Experiment (FDRAKE). The vessels were: R/V CONRAD, R/V MELVILLE and ARA ISLAS ORCADAS. The tracks of the three ships were shown. Each vessel made hydrographic stations, dropped expendable bathythermographs (XBT's) and collected underway oceanographic and meteorological data. The MELVILLE was also used to deploy a moored array of current, temperature and tide recorders. Some of the moorings were recovered during FDRAKE 75; the remainder was set as a year long array and recovered during FDRAKE 76. The hydrographic bottle and STD data collected aboard the MELVILLE were presented. GRA

N78-18669# Royal Netherlands Meteorological Inst., De Bilt.
SEA SURFACE TEMPERATURE DETERMINATION FROM INFRARED RADIATION. A CRITICAL EVALUATION OF THE METHOD

C. Kraan 1977 116 p refs In DUTCH; ENGLISH summary (KNMI-WR-77-5) Avail: NTIS HC A06/MF A01

Ten experimental flights with an infrared radiation thermometer (Barnes PRT-5) were carried out in various seasons over a sea area adjacent to the Netherlands coast 100 km long and 20 km wide in order to assess the value of this method of sea temperature measurement in connection with the study of coastal water circulation. It is concluded that the accuracy to which the mixed layer temperature can be determined is less than could be deduced from many literature data. The calibration procedure for the instrument was improved. From a comparison between six published correction methods for obtaining the skin temperature from the instrument signal it is concluded that those proposed by Tien (1974) and by Shaw and Irbe (1972) are most suitable. It is shown that the distribution of sea surface temperature over this coastal area within one tidal period can be reasonably well represented (with a standard random error of 0.4 C) in a digital grid with a mesh size of 1.5 km. Author (ESA)

N78-19346* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BROAD PERSPECTIVES IN RADAR FOR OCEAN MEASUREMENTS

Atul Jain 15 Feb. 1978 34 p refs (Contract NAS7-100) (NASA-CR-155941; JPL-Pub-78-4) Avail: NTIS HC A03/MF A01 CSCL 17I

The various active radar implementation options available for the measurement functions of interest for the SEASAT follow-on missions were evaluated. These functions include surface feature imaging, surface pressure and vertical profile, atmospheric sounding, surface backscatter and wind speed determination, surface current location, wavelength spectra, sea surface topography, and ice/snow thickness. Some concepts for the Synthetic Aperture Imaging Radar were examined that may be useful in the design and selection of the implementation options for these missions. The applicability of these instruments for the VOIR mission was also kept under consideration. Author

N78-20572* Applied Science Associates, Inc., Apex, N. C.
CORRELATION OF SIGMA DEG (0 DEG) INFERRED WIND SPEED ESTIMATES WITH NOAA HINDCAST DATA

Gary S. Brown Mar. 1978 21 p refs (Contract NAS6-2810) (NASA-CR-141437) Avail: NTIS HC A02/MF A01 CSCL 04B

Microwave remote sensing is discussed in terms of using GEOS-3 data to infer surface wind speed. Topics covered include: determining surface wind speed from backscattering, estimating surface winds from near normal incidence scattering, and response of the centimeter wavelength components of the ocean surface height spectrum to the wind. J.M.S.

N78-20946* Wentz (Frank J.) and Associates, San Francisco, Calif.

ESTIMATION OF THE SEA SURFACE'S TWO-SCALE BACKSCATTER PARAMETERS

Frank J. Wentz Mar. 1978 126 p refs (Contract NAS1-14775) (NASA-CR-145255) Avail: NTIS HC A07/MF A01 CSCL 20F

The relationship between the sea-surface normalized radar cross section and the friction velocity vector is determined using a parametric two-scale scattering model. The model parameters are found from a nonlinear maximum likelihood estimation. The estimation is based on aircraft scatterometer measurements and the sea-surface anemometer measurements collected during the JONSWAP '75 experiment. The estimates of the ten model parameters converge to realistic values that are in good agreement with the available oceanographic data. The rms discrepancy

between the model and the cross section measurements is 0.7 db, which is the rms sum of a 0.3 db average measurement error and a 0.6 db modeling error. Author

N78-21506# National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.

SUMMARIZATION AND INTERPRETATION OF HISTORICAL PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION FOR THE MID-ATLANTIC REGION

Final Report
Robert G. Williams and Fredric A. Godshall Oct. 1977 307 p
Sponsored by Bureau of Land Management, Wash. D. C.
(PB-277104/6; NOAA-78011611) Avail: NTIS
HC A14/MF A01 CSDL 13B

The results of an environmental study of the Mid-Atlantic region of the Outer Continental Shelf were described. The main body of oceanographic data consist of salinity, temperature, depth, and Nansen casts, supplemented by ship drift observations, and current meter records. The surface wind field, which plays an important role in determining the movement of spilled oil and other pollutants, was dealt with in detail. The physical characteristics of the water masses in the Mid-Atlantic region, whose structure and variability are particularly relevant to the dispersion and advection of pollutants was discussed and circulation features were analyzed. GRA

N78-21552*# American Univ., Washington, D. C. Dept. of Biology.

INFERRING NUTRIENT LOADING OF ESTUARINE SYSTEMS BY REMOTE SENSING OF AQUATIC VEGETATION

Richard R. Anderson *In* NASA, Goddard Space Flight Center
Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 275-281 refs
Avail: NTIS HC A17/MF A01 CSDL 08A

The use of remote sensing to record algal and vascular aquatic plant growths in estuarine waters is discussed. A technique is proposed that uses a combination of data to hierarchically classify watersheds with regard to severity of potential pollution. Specific nonpoint sources of nutrients in tributaries of the watershed are identified with lower altitude photography of vegetation and selected ground sampling. It is concluded that excessive growths of some aquatic plants may be related to nutrient pollution. Author

N78-21554*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

ROLE OF REMOTE SENSING IN DOCUMENTING LIVING RESOURCES

Peter E. Wagner, Richard R. Anderson, Bert Brun, Max Eisenberg, John B. Genys, Donald W. Lear, Jr., and Myron H. Miller *In its*
Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 297-301 refs
Avail: NTIS HC A17/MF A01 CSDL 08A

Specific cases of known or potentially useful applications of remote sensing in assessing biological resources are discussed. It is concluded that the more usable remote sensing techniques relate to the measurement of population fluctuations in aquatic systems. Sensing of the flora and the fauna of the Bay is considered with emphasis on direct sensing of aquatic plant populations and of water quality. Recommendations for remote sensing projects are given. J.M.S.

N78-21584# National Environmental Satellite Service, Washington, D. C.

LAKE ERIE ICE: WINTER 1975 - 1976

Jenifer H. Wartha Aug. 1977 76 p refs
(PB-276386/0; NOAA-TM-NESS-90; NOAA-77120101) Avail:
NTIS HC A05/MF A01 CSDL 04B

The formation, movement, and decay of lake ice were traced. Wind speeds and directions were correlated with ice movement, and air temperatures were related to ice formation and dissipation. GRA

N78-21738# Naval Research Lab., Washington, D. C. Advanced Space Sensing Applications Branch.

ESTIMATION OF MARINE ENVIRONMENTAL PARAMETERS USING MICROWAVE RADIOMETRIC REMOTE SENSING SYSTEMS **Interim Report**

MacMillan M. Wisler and James P. Hollinger Nov. 1977 59 p refs
(WF52551718)

(AD-A049507; AD-E000096; NRL-MR-3661) Avail: NTIS
HC A04/MF A01 CSDL 08/10

This is an interim report on an ongoing program to develop a passive microwave system for the remote all-weather measurement of sea surface temperature from a satellite platform. It presents a general method for obtaining optimal linear algorithms for the reduction of multifrequency radiometer data to determine marine environmental variables. The mean square errors in determining the environmental variables are also determined thereby enabling the evaluation of different passive microwave radiometric systems. This method, called the 'Environmental Transfer Function', includes in its analysis the error contributions from three sources: errors in measuring microwave brightness temperature, the statistical variances of the environmental parameters, and uncertainties in the equations used to relate the brightness temperatures to the environmental parameters. The mathematical formulation is first developed and then an example application is given to evaluate the remote sensing capability of selected radiometric systems. Author (GRA)

N78-21980# National Academy of Sciences - National Research Council, Washington, D. C. Ocean Sciences Board.

THE QUALITY OF NOAA'S OCEAN RESEARCH AND DEVELOPMENT PROGRAM: AN EVALUATION

1977 149 p
(PB-277095/6; NOAA-78020801) Avail: NTIS
HC A07/MF A01 CSDL 05A

The quality, vitality, and health of the ocean research and development conducted by the National Oceanic and Atmospheric Administration (NOAA) in comparison with others in the ocean science community is discussed. The ocean R&D carried out within all the major line components is intended in part to meet statutory responsibilities which cover a broad range, including fisheries, ocean dumping and marine protection, disasters and the environment, some marine mammals, coastal zone management, mapping and charting, energy, and ocean technology. Individual reports on each component summarize their strengths and weaknesses. Recommendations for improvement are delineated. GRA

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HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A78-21346 * Outfall siting with dye-buoy remote sensing of coastal circulation. J. C. Munday, Jr., C. S. Welch, and H. H. Gordon (Virginia Institute of Marine Science, Gloucester Point, Va.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Jan. 1978, p. 87-96. 23 refs. Research supported by the Hampton Roads Sanitation District Commission; Grant No. NGL-47-022-005.

A dye-buoy remote sensing technique has been applied to estuarine siting problems that involve fine-scale circulation. Small hard cakes of sodium fluorescein and polyvinyl alcohol, in anchored buoys and low-windage current followers, dissolve to produce dye marks resolvable in 1:60,000 scale color and color infrared imagery. Lagrangian current vectors are determined from sequential photo coverage. Careful buoy placement reveals surface currents and submergence near fronts and convergence zones. The technique has been used in siting two sewage outfalls in Hampton Roads, Virginia: In case one, the outfall region during flood tide gathered floating materials in a convergence zone, which then acted as a secondary source during ebb; for better dispersion during ebb, the proposed outfall site was moved further offshore. In case two, flow during late flood was found to divide, with one half passing over shellfish beds; the proposed outfall site was consequently moved to keep effluent in the other half. (Author)

A78-23105 # Possibilities and limits regarding the infrared-gas-analysis detection of toxic effects in the case of aquatic plants, giving particular attention to problems involving heavy metal ions (Möglichkeiten und Grenzen infrarotgasanalytischer Erfassung toxischer Effekte bei Wasserpflanzen, unter besonderer Berücksichtigung der Schwermetallproblematik). G. Weise (Dresden, Technische Universität, Dresden, East Germany). *Dresden, Technische Universität, Wissenschaftliche Zeitschrift*, vol. 26, no. 6, 1977, p. 1161-1165. 8 refs. In German.

The study of the CO₂-gas metabolism of submerged marophytes by means of techniques based on the employment of infrared gas analysis makes it possible to investigate the behavior of these organisms in response to toxic stresses. Appropriate analytical techniques have been described by Auerbach et al. (1972). Typical effects observed are related to a reduced net assimilation accompanied by unchanged respiration under darkness conditions, an increased respiration in darkness accompanied by unchanged net assimilation, and a reduction of the total metabolism. The effects of the day-night cycle of the CO₂ metabolism of *Amblystegium riparium* and *Potamogeton pectinatus* produced by cobalt, nickel, zinc, and copper are shown in graphs. The results illustrate a higher toxic effectiveness of Cu(2+) compared to Ni(2+). The gas metabolism of plants is found to be an indicator of very great sensitivity for the level of plant vitality and the susceptibility of the plant to toxic stresses. G.R.

A78-23116 Passive remote sensing techniques for mapping water depth and bottom features. D. R. Lyzenga (Michigan, Environmental Research Institute, Ann Arbor, Mich.). *Applied Optics*, vol. 17, Feb. 1, 1978, p. 379-383. 15 refs. Contract No. N00014-74-C-0273.

Ratio processing methods are reviewed, and a new method is proposed for extracting water depth and bottom type information

from passive multispectral scanner data. Limitations of each technique are discussed, and an error analysis is performed using an analytical model for the radiance-over shallow water. (Author)

A78-25824 # Diffraction scattering of microwaves from the mountain ridges. V. N. Troitskii (Union Radio Scientifique Internationale, Moscow, USSR). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 121-124.

The paper describes different approaches to approximating the microwave diffraction field that results from scattering caused by irregularities in a mountain surface. Problems considered include severe diffraction field distortion in the obstacle shadow, changes in phase relations of waves diffracted by different parts of an irregular ridge, wave energy losses, multipath propagation, and antenna gain loss. The effects of mountain snow and ice on the microwave field is discussed. Snow may cause wave refraction similar to refraction in a dielectric prism; the highest signal level is observed immediately after a snowfall as fresh snow being less dense than compacted snow has a lower refraction coefficient. M.L.

A78-25885 # Attenuation from dual-wavelength radar observations of hailstorms. P. J. Eccles (National Center for Atmospheric Research, Boulder, Colo.). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 511-514. 16 refs. NSF-sponsored research.

The Grover S and X-band dual-wavelength radar system has been applied to measuring differential attenuation in three dimensions. The system utilizes a smoothing algorithm for the practical deduction of the differential attenuation, and may be used for any type of density of precipitation particles in severe storms. It has been found that attenuation derived by this technique, and transformed into a water deposition rate, yields a value of radar-estimated total water over a series of ground-based precipitation monitors that agrees with ground truth. S.C.S.

A78-25895 # Hydrological applications of radar. F. T. Ulaby and P. P. Batlivala (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 567-571.

Based on a variety of considerations including small-scale and large-scale soil surface roughness, surface slope, soil type and vegetation cover, the following radar parameters for monitoring soil moisture are recommended: 4 GHz, an angle of incidence range of 7-17 deg and HH polarization. Measurements indicate that superior performance would be realized in monitoring soil moisture under a vegetation canopy if the crop cover type is known. It has been shown that a 14 GHz radar can provide such information with a high degree of classification accuracy. B.J.

A78-27766 * Chemical whittings and chlorophyll distributions in the Great Lakes as viewed by Landsat. A. E. Strong (NOAA, National Environmental Satellite Service, Washington, D.C.). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 61-72. 8 refs. Research supported by the U.S. Department of the Interior; NASA Order S-70246-AG.

A chemical precipitation of calcium carbonate, or whiting, was first observed by satellite in Lake Michigan during August 1973. Since that initial observation similar events have been noted in Lakes Michigan, Erie, and Ontario with imagery from Landsat, Skylab, and

NOAA satellites. By the use of Landsat multispectral data together with NOAA thermal infrared data, it has been observed that whittings occur several meters below the lake surface in relatively warm water. They are most vividly displayed during and after periods of upwelling. As the epilimnetic waters become supersaturated with Ca^{+2} ions during summer, a triggering mechanism (presumably biological or physical) initiates the whiting, which may continue for several months. The effects on the biota of the euphotic zone when this milky cloud is present in the upper layers are poorly understood. However, Great Lakes circulation studies are taking advantage of these natural dye tracers. (Author)

A78-28389 The use of infrared airborne remote sensing for the location of infiltration and emergence zones of karstic aquifers - Consequences for the protection and management of these environments (Utilisation de la télédétection aéroportée infra-rouge pour la localisation des zones d'infiltration et d'émergence des aquifères karstiques - Conséquences pour la protection et l'aménagement de ces milieux). E. Marjolet and G. Marjolet (Centre d'Etudes et de Recherches Géologiques et Hydrologiques, Montpellier, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 175-181. In French.

A78-28390 Results of airborne operations over the Bec d'Ambès zone and the central Dordogne (Résultats des opérations aéroportées sur la zone du Bec d'Ambès et la moyenne Dordogne). L. Caillon, J. C. Gros, Ch. Béliard, and P. Ch. Lévêque (Bordeaux I, Université, Talence, Gironde, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 183-234. 20 refs. In French.

Results of an aerial reconnaissance campaign to solve problems of sedimentation dynamics in the Bec d'Ambès region of France are reported; in a second program, the surface and subterranean hydrology as well as the structural geology of the valley region of the central Dordogne are investigated. The observing campaigns involve multispectral scanning data and color infrared imagery. The Dordogne observations also include a nocturnal thermal survey. Turbidity in the estuary zone of La Gironde is discussed on the basis of the data. J.M.B.

A78-28398 The Rhone estuaries project (Le projet bouches du Rhône). J. P. Gilg (EHESS, Paris, France), M. Bied-Charéton (Office de la Recherche Scientifique et Technique d'Outre-Mer, Paris, France), and P. Fournier (Ministère de l'Agriculture, Paris, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 381-406. In French.

A general survey of the Rhone estuaries project is given. Broad objectives are identified with reference to thematic, methodological, and satellite observation goals. Ground observations are discussed along with techniques for data interpretation. A research and development program is outlined, noting methods for improving data, studies of ground truth, and the treatment and analysis of textures. S.C.S.

A78-28403 The identification of hydrogeology components in a basin via multispectral scanning detector images (Identification de composantes hydrogéologiques d'un bassin à partir des images de détecteur multispectral à balayage). M. Canceill, Y. Vuillaume (Bureau de Recherches Géologiques et Minières, Orléans, France), and L. Cairo (Centre de Recherches en Physique de

l'Environnement, Orléans, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 463-498. 10 refs. In French.

Remote sensing techniques have been applied to the management of water resources at a hydrogeological test site in the Rhone estuary region of France. Data were obtained by Daedalus and Landsat equipment; images ranged from 1:10,000 to 1:500,000. The data were processed by: (1) numerical handling and image thematic analysis, (2) computer classification based on both supervised and unsupervised processing, (3) multivariate discriminate analysis, (4) color-coding of visualized classes using photographic and photopolymeric methods, and (5) comparison with ground truth. S.C.S.

A78-29580 Wetland mapping in New Jersey and New York. W. W. Brown (Earth Satellite Corp., Washington, D.C.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Mar. 1978, p. 303-314. 22 refs.

The wetlands of New Jersey and New York were mapped recently using 1:12,000 scale color and/or color infrared aerial photographs. In support of tidal wetlands legislation, the Mean High Water (approximate position) and Upper Wetland Boundary lines were delineated using a biological entity - plant species. In New Jersey, dominant plant species were identified on each map. In New York, a broader classification system was used based on plant species categories such as Coastal Fresh Marsh, High Marsh, etc. For successful implementation of projects of this type, it is critical that mapping conventions and procedures be developed at the onset of the program. These mapping criteria, however, may be modified as the program proceeds and the need arises. Also, a thorough understanding of aerial photographic interpretation of plant species signatures under varying conditions is essential. (Author)

A78-30291 Signatures of snow in the 5 to 94 GHz range. R. Hofer and E. Schanda (Bern, Universität, Berne, Switzerland). *Radio Science*, vol. 13, Mar.-Apr. 1978, p. 365-369. 6 refs. Research supported by the Eidgenössisches Institut für Schnee- und Lawinenforschung.

A long-term observational study of the microwave emission and scattering behavior of snow under quasi-controlled conditions was started recently on a high-altitude Alpine test site. Results of the first set of measurements, carried out with five radiometers at frequencies of 4.9, 10.5, 21, 36, and 94 GHz, are reported and preliminary interpretations are given. The spectral reversal of the brightness temperature and its dependence on look angle and polarization provides a means to distinguish between different snow states and to estimate the wetness factors of the surface layer of the snow pack. From an electromagnetic scattering standpoint, snow cover is an excellent medium to use for studying volume scattering. (Author)

A78-31350 # Studying the ice cover by thermal aerial photographs (Izuchenie ledianogo pokrova teplovoi aeros'emkoi). B. V. Shilin (Nauchno-Proizvodstvennoe Ob'edinenie 'Aerologiya', Leningrad, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 238, Jan. 11, 1978, p. 459-461. 6 refs. In Russian.

Using thermal aerial photographs, studies are made of the ice cover in arctic regions. It is noted that for determining the thickness of the ice cover the best photographs are those taken at night when there are no interfering solar contrasts. In photographs of the frozen arctic tundra and large lakes three types of ice are discernible: very thick ice formed during the initial stages of lake freezing and located at the lower depths, less thick ice forming a large area in the central portion of the lake, and thin ice at the lake surface. The photographs also show the screening effect of the snow cover where a variegated pattern of ice in the middle and upper portions of the lake is caused by snow drifts. S.C.S.

A78-32110 A methodology for assessing land application of sludges and wastewaters. S. Chatterjee (Miami Valley Regional Planning Commission, Dayton, Ohio). In: Environmental technology '77; Proceedings of the Twenty-third Annual Technical Meeting, Los Angeles, Calif., April 25-27, 1977. Mount Prospect, Ill., Institute of Environmental Sciences, 1977, p. 107-113. 14 refs.

A78-32394 Snowfield assessment from Landsat. I. L. Thomas (Department of Scientific and Industrial Research, Lower Hutt, New Zealand), N. P. Ching (New Zealand Forest Service, Wellington, New Zealand), and A. J. Lewis. *Photogrammetric Engineering and Remote Sensing*, vol. 44, Apr. 1978, p. 493-502. 5 refs.

The potential use of Landsat MSS data for routine monitoring of the area and condition of a snowfield is explored. Area measurements are readily possible from both the photographic product and the CCT data. The CCT data also may reveal variations in snow density and/or moisture content, and have a spatial resolution equal to, or better than, the photographic product. A nonsubjective analysis technique based on the CCT data product is advanced and is used, together with isodensitometric techniques applied to the photographic product, in this snowfield assessment. This study demonstrates that Landsat MSS data have the potential for contributing to rapid assessment and management of snowfield resources, especially if repetitive satellite coverage is obtained.

(Author)

N78-16403 Nevada Univ., Reno. **MODELING AND ANALYSIS OF HYDRAULIC INTERCHANGE OF SURFACE AND GROUND WATER** Ph.D. Thesis

Alfred Benjamin Cunningham 1977 187 p
 Avail: Univ. Microfilms Order No. 77-25079

A technique for modeling the hydraulic interchange between surface and ground water in an unconfined aquifer-river system was developed. Model predictive uncertainty consisted of statistical comparison of model output with field observations. Results indicated generally good overall predictive capability and included fair to good prediction of extreme high and low river stage and ground water table elevations. A procedure for quantifying uniqueness of model solution was developed. Uniqueness of solution investigation provided insight into the reliability associated with extrapolation of model results beyond the limits of observed field measurements. The model was utilized to delineate interrelationships among individual hydrologic system components as well as to determine the degree of influence of various parameters on system behavior. Dissert. Abstr.

N78-16406 Kansas Univ., Lawrence. **RESERVOIR WATER QUALITY MONITORING WITH ORBITAL REMOTE SENSORS** Ph.D. Thesis

James Raymond McCauley 1977 111 p
 Avail: Univ. Microfilms Order No. 77-28892

Remotely sensed data acquired by the LANDSAT and Skylab satellites over major reservoirs in Kansas were studied to determine the feasibility of monitoring fresh water resources by satellite. The Tuttle Creek and Perry reservoirs were studied to determine the properties of reservoirs which control the spectral intensity of reflected sunlight as detected by the sensors. Water samples were collected from these two lakes concurrent with satellite overpass and were analyzed to determine the amount of suspended solids, chlorophyll content, and concentrations of phosphate, nitrate, and potassium ions, as well as water temperature and turbidity. Images in four spectral bands were regularly received for each satellite overpass. Computer compatible tapes were obtained retrospectively for most of the usable passes over the lakes. These have been processed and the output analyzed to determine the bands which best reflect water quality parameters measured. Dissert. Abstr.

N78-16407* Environmental Research and Technology, Inc., Concord, Mass.

INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Progress Report, Oct. - Dec. 1977

James C. Barnes, Principal Investigator 10 Jan. 1978 5 p
 Sponsored by NASA .ERTS
 (E78-10051; NASA-CR-155510) Avail: NTIS
 HC A02/MF A01 CSCL 08L

N78-16410* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

THE USE OF SNOWCOVERED AREA IN RUNOFF FORECASTS

Albert Rango, Jack F. Hannaford, Roderick L. Hall, Michael Rosenzweig, and A. Jean Brown Mar. 1977 33 p refs
 (NASA-TM-78083; X-913-77-48) Avail: NTIS
 HC A03/MF A01 CSCL 08L

Long-term snowcovered area data from aircraft and satellite observations have proven useful in reducing seasonal runoff forecast error on the Kern river watershed. Similar use of snowcovered area on the Kings river watershed produced results that were about equivalent to methods based solely on conventional data. Snowcovered area will be most effective in reducing forecast procedural error on watersheds with: (1) a substantial amount of area within a limited elevation range; (2) an erratic precipitation and/or snowpack accumulation pattern not strongly related to elevation; and (3) poor coverage by precipitation stations or snow courses restricting adequate indexing of water supply conditions. When satellite data acquisition and delivery problems are resolved, the derived snowcover information should provide a means for enhancing operational streamflow forecasts for areas that depend primarily on snowmelt for their water supply.

Author

N78-16559* Washington Univ., Seattle. Cloud Physics Group.

TRACER AND DIFFUSION AND CLOUD MICROPHYSICAL STUDIES IN THE AMERICAN RIVER BASIN Final Report, Oct. 1976 - Nov. 1977

Arthur L. Rango, Peter V. Hobbs, and Lawrence F. Radke Aug. 1977 255 p
 (Contract DI-6-07-DR-20140)
 (PB-272426/8; FR-1) Avail: NTIS HC A12/MF A01 CSCL 04B

An airborne field study was conducted over the American River Basin of the Sierra Nevada for the purpose of: (1) determining the transport and diffusion of materials released from the ground and the air during various types of storm situations; (2) comparing the observed plumes with those predicted by stratified tank model simulations; (3) obtaining cloud microphysical measurements; (4) obtaining airborne precipitation particle measurements in support of an auxiliary study comparing radar reflectivities and precipitation rates on the ground; and (5) searching for extraneous ice nucleus sources which could affect the Basin. GRA

N78-17420 Stanford Univ., Calif.

THE USE OF DIGITAL SIMULATION MODELS TO PREDICT THE EFFECTS OF VEGETATION COVER CHANGE ON STREAMFLOW AND DOWNSTREAM WATER USE Ph.D. Thesis

06 HYDROLOGY AND WATER MANAGEMENT

Lloyd John Lundeen 1977 218 p
Avail: Univ. Microfilms Order No. 77-25697

The effect that major vegetative change or complete removal of plant cover would have on both the hydrologic behavior of the watershed and on the availability and use of water downstream from the source area watershed was analyzed. The applicability of several computerized simulation models to answer these questions was also tested. Dissert. Abstr.

N78-17421 Colorado Univ., Boulder.
STATISTICAL ANALYSIS OF THE LIQUID WATER DISTRIBUTION IN A HIGH ALTITUDE SNOWPACK Ph.D. Thesis
Thomas Ray Carroll 1977 86 p
Avail: Univ. Microfilms Order No. 77-29901

The formation, movement, storage, and distribution of liquid water in an isothermal snowpack are examined in the framework of an empirically derived computational model. The model incorporates the major heterogeneities within the pack in an attempt to describe the diurnal and seasonal liquid water distribution within a subalpine isothermal snowpack. The model accounts for diffusion or percolation through an assumed homogeneous snow layer and rapid flow through pipes in snow layers and drains in ice lenses. The model also simulates the ponding of liquid water above semipervious layering within the pack. Dissert. Abstr.

N78-17422 Colorado Univ., Boulder.
PREDICTION OF NATURAL SNOWDRIFT ACCUMULATION ON ALPINE RIDGE SITES Ph.D. Thesis
Neil Hjalmar Berg 1977 320 p
Avail: Univ. Microfilms Order No. 77-29899

A set of hypotheses concerning the development of snowdrifts on natural terrain in alpine areas is presented and transformed into a computer simulation model predicting the location and extent of snowdrift accumulation. Locations in the lower atmospheric boundary layer are specified where topographic changes cause flow expansions so that wind speed decreases below that required to keep snow particles in eolian transport. Several zones of flow are described. Eolian snow particle movement is described. Field experimentation at three sites on Niwot Ridge in the Colorado Front Range were undertaken to test the model and to provide additional information on natural snowdrift development. Dissert. Abstr.

N78-17423 Iowa State Univ. of Science and Technology, Ames.
GROUNDWATER FLOW IN DOUBLE POROSITY MEDIA: CARBONATE ROCKS Ph.D. Thesis
Yakup Basmaci 1977 141 p
Avail: Univ. Microfilms Order No. 77-29823

A coupled saturated-unsaturated groundwater flow model through double porosity media is developed. The model assumes fracture and matrix porosity, and considers caves, and large scale solution channels as boundary conditions in carbonate rocks. The continuum approach is used in the development of the flow equation. A quasi-steady state flow between the matrix and the fractures is assumed. A computer program of the mathematical model is developed and tested by using finite difference equations. Three problems are solved. It is concluded that, spring flow from carbonate terranes mainly originates from unsaturated flow through the matrix-fracture system. The matrix acts like a reservoir providing the sustained yield for springs. Dissert. Abstr.

N78-17426 Montana State Univ., Bozeman.
A STRUCTURAL THEORY FOR THE DEFORMATION OF SNOW Ph.D. Thesis
William Francis St. Lawrence 1977 155 p
Avail: Univ. Microfilms Order No. 77-29307

An equation to describe the plastic portion of the deformation was developed by considering the relationship between three fundamental variables. These variables are the mean spacing

between ice grains, the relative velocity between grain and the fraction of the total number of grains which participate in the deformation process. The mean distance between ice grains was determined by considering stereologically the snow structure. The velocity component was found by observing the relaxation of the snow. To determine the mobility of the ice grains acoustic emission data was used. An equation describing the pattern of acoustic response at constant rates of deformation was derived and applied to a number of tests. Combining the above variables produces a constitutive equation which reflects the actual behavior of the snow. Dissert. Abstr.

N78-17427* South Dakota State Univ., Brookings. Remote Sensing Inst.

HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Quarterly Progress Report, Oct. - Dec. 1977

Donald G. Moore, Principal Investigator and J. Heilman Dec. 1977 4 p ERTS
(Contract NAS5-24206)
(E78-10054; NASA-CR-155548; QPR-2) Avail: NTIS
HC A02/MF A01 CSDL 08H

N78-17430* Geological Survey, Reston, Va. Water Resources Div.

APPLICATION OF REMOTELY-SENSED LAND USE INFORMATION TO IMPROVE ESTIMATES OF STREAMFLOW CHARACTERISTICS, VOLUME 8 Final Report

Edward J. Pluhowski, Principal Investigator Aug. 1977 84 p refs ERTS

(NASA Order S-70243-AG)
(E78-10057; NASA-CR-155551) Avail: NTIS
HC A05/MF A01 CSDL 08H

The author has identified the following significant results. Land use data derived from high altitude photography and satellite imagery are presented for 49 basins in Delaware, and eastern Maryland and Virginia. Applying multiple regression techniques to a network of gaging stations monitoring runoff from 39 of the basins, it was demonstrated that land use data from high altitude photography provided an effective means of significantly improving estimates of stream flow. Forty stream flow characteristic equations for, incorporating remotely sensed land use information were compared with a control set of equations, using map derived land cover. Significant improvement was detected in six equations where level 1 data were added and five equations were improved significantly using land use data derived from LANDSAT imagery. Significant losses in accuracy due to the use of remotely sensed land use information were detected only in estimates of flood peaks.

N78-17441* Delaware Univ., Newark. Center for Remote Sensing.

APPLICATION OF LANDSAT TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES Final Report, Feb. 1976 - Dec. 1977

V. Klemas, R. Rogers, (Bendix Aerospace Systems Div., Ann Arbor, Mich.), D. Bartlett, G. Davis, and W. Philpot Dec. 1977 142 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Contract NAS5-20983)
(E78-10068; NASA-CR-155609) Avail: NTIS CSDL 08C

The author has identified the following significant results. LANDSAT data were found to be the best source of synoptic information on the distribution of horizontal water mass discontinuities (fronts) at different portions of the tidal cycle. Distributions observed were used to improve an oil slick movement prediction model for the Delaware Bay. LANDSAT data were used to monitor the movement and dispersion of industrial acid waste material dumped over the continental shelf. A technique for assessing aqueous sediment concentration with limited ground truth was proposed.

N78-17458# Purdue Univ., Lafayette, Ind. Water Resources Research Center.

SYSTEMATIC DEVELOPMENT OF METHODOLOGIES IN PLANNING URBAN WATER RESOURCES FOR MEDIUM SIZE COMMUNITIES: APPLICATION OF LINEAR SYSTEMS ANALYSIS TO GROUND WATER EVALUATION STUDIES

C. T. Bathals, Ramachandra Rao, and J. A. Spooner Feb. 1977 143 p refs

(Contract DI-14-31-0001-5213)

(PB-273886/2; PWRR-TR-91; W78-00570;

OWRT-C-6106(5213)(2)) Avail: NTIS HC A07/MF A01 CSCL 08H

A generalized linear model was used to analyze groundwater flow in a stream-well-aquifer system. A procedure was developed to predict aquifer response by considering the cause and effect relationships of the groundwater flow system. In this procedure, historical records of pumping rates, groundwater levels and stream stages, and estimated storage coefficients were used as inputs. The utility of this procedure for analysis of regional aquifer systems was demonstrated by using both field and hypothetical data and satisfactory results were obtained. GRA

N78-18476 Rutgers - The State Univ., New Brunswick, N. J. **EVALUATION OF CIRCULATION IN PARTIALLY STRATIFIED ESTUARIES AS TYPIFIED BY THE HUDSON RIVER** Ph.D. Thesis

Karim Arieby Abood 1977 451 p

Avail: Univ. Microfilms Order No. 77-24951

The methods developed in the course of this study include the: Advective Salt Budget, Two Layer Stratified Flow, Generalized Salinity Profiles, Semi-Analytical Closed Form Solution, and the Three Dimensional Steady State Model. The first four methods were previously developed and/or generalized in this study. The three dimensional model is the main contribution of this study.

Dissert. Abstr.

N78-18482*# Texas A&M Univ., College Station. Remote Sensing Center.

SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS Final Report

Bruce J. Blanchard, Principal Investigator and Walter Bausch Jan. 1978 58 p refs ERTS

(Contract NAS5-22534)

(E78-10073; NASA-CR-155718; RSC-3273) Avail: NTIS HC A04/MF A01 CSCL 08H

The author has identified the following significant results. It was apparent that the spectra calibration of runoff curve numbers cannot be achieved on watersheds where significant areas of timber were within the drainage area. The absorption of light by wet soil conditions restricts differentiation of watersheds with regard to watershed runoff curve numbers. It appeared that the predominant factor influencing the classification of watershed runoff curve numbers was the difference in soil color and its associated reflectance when dry. In regions where vegetation grown throughout the year, where wet surface conditions prevail or where watersheds are timbered, there is little hope of classifying runoff potential with visible light alone.

N78-18483*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.

USE OF LANDSAT-1 DATA FOR THE DETECTION AND MAPPING OF SALINE SEEPS IN MONTANA

G. A. May, Principal Investigator and G. W. Petersen Mar. 1976 87 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Contract NAS5-2304)

(E78-10074; NASA-CR-156686; ORSER-SSEL-TR-4-76) Avail: NTIS HC A05/MF A01 CSCL 08G

The author has identified the following significant results. April, May, and August are the best times to detect saline seeps. Specific times within these months would be dependent upon

weather, phenology, and growth conditions. Saline seeps can be efficiently and accurately mapped, within resolution capabilities, from merged May and August LANDSAT 1 data. Seeps were mapped by detecting salt crusts in the spring and indicator plants in the fall. These indicator plants were kochia, inkweed, and foxtail barley. The total hectares of the mapped saline seeps were calculated and tabulated. Saline seeps less than two hectares in size or that have linear configurations less than 200 meters in width were not mapped using the LANDSAT 1 data. Saline seep signatures developed in the Coffee Creek test site were extended to map saline seeps located outside this area.

N78-18574# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

INVESTIGATION OF REMOTE WATER-QUALITY MONITORING SYSTEMS FOR USE WITH GOES OR ERTS WATER DATA TRANSMITTER Final Report, Jul. - Dec. 1976

Alfred W. Ford Nov. 1977 50 p

(AD-A047795; WES-TR-Y-77-5)

Avail: NTIS

HC A03/MF A01 CSCL 17/2

A field demonstration was implemented to deploy under actual field conditions several water-quality monitoring systems to determine their overall suitability and compatibility with the LaBarge designed remote water data transmitter. In addition, the study was to establish an information base upon which decisions could be made for selecting water-quality monitoring equipment capable of gathering reliable data for extended periods with limited maintenance. GRA

N78-19569*# National Oceanic and Atmospheric Administration, Washington, D. C.

APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report

Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 1 Mar. 1978 6 p Sponsored by NASA ERTS

(E78-10090; NASA-CR-155795; QR-2) Avail: NTIS HC A02/MF A01 CSCL 08H

N78-19577*# California Univ., Berkeley. Electronics Research Lab.

MICROWAVE SCATTERING PROPERTIES OF SNOW FIELDS

D. J. Angelakos Dec. 1977 6 p refs Presented at the NASA Microwave Remote Sensing Symp., Houston, Tex., 6-7 Dec. 1977

(Grant NSG-5093)

(NASA-CR-155799) Avail: NTIS HC A02/MF A01 CSCL 08L

Experimental results were presented showing backscatter dependence on frequency, angle of incidence, snow wetness, and frequency modulation. Theoretical studies were made of the inverse scattering problem yielding some preliminary results concerning the determination of the dielectric constant of the snow layer. The experimental results lead to the following conclusions: (1) snow layering affects backscatter; (2) layer response was significant up to 45 degrees of incidence; (3) wetness modifies snow layer effects; and (4) frequency modulation masks the layer response. Author

N78-19578*# California Univ., Berkeley.

COHERENT MICROWAVE BACKSCATTER OF NATURAL SNOWPACKS

W. I. Linlor (NASA Ames Res. Center), D. J. Angelakos, F. D. Clapp, and J. L. Smith (Forest Service, Berkeley, Calif.) 1977 18 p refs

(Grant NSG-5093)

(NASA-CR-155800) Avail: NTIS HC A02/MF A01 CSCL 08L

The backscatter of natural snowpacks was measured using a swept-frequency system operating from 5.8 to 8.0 GHz. Snow

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layering produced sequences of maxima and minima in backscatter intensity, with typical peak-to-valley ratios of 15 db. Wetness produced in the upper portion of the snowpack by solar heat input enhanced the effect of layering. The layer response persisted for incidence exhibits predominantly coherent properties. Frequency modulation of the incident signal masked the layer response by averaging the unmodulated response over the bandwidth represented by the modulation. Further changes in backscatter were attributed to changes in wetness in the surface regions of the snowpack; for a fixed frequency of 13.5 GHz and incidence angle of 39 deg, the backscatter decreased typically 15 db between 11 A.M. and noon, and returned to approximately its initial level of overnight. Author

N78-20566*# Department of the Environment, Ottawa (Ontario). **RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Oct. - Dec. 1977**

R. A. Halliday, Principal Investigator and I. A. Reid Feb. 1978 8 p Sponsored by NASA ERTS (E78-10091; NASA-CR-155772) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. The feasibility of transmitting hydrometric data in the LANDSAT and GOES mode and using these data operationally was demonstrated. All elements except for the GOES downlink at PASS are functioning well.

N78-20569*# Corps of Engineers, Waltham, Mass. **THE USE OF THE LANDSAT DATA COLLECTION SYSTEM AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Final Report**

Saul Cooper, Principal Investigator, Timothy D. Buckelew, Harlan L. McKim (Cold Regions Research and Engineering Lab., Hanover, N. H.), and Carolyn J. Merry (Cold Regions Research and Engineering Lab., Hanover, N. H.) Nov. 1977 168 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (E78-10102; NASA-CR-155964) Avail: NTIS HC A08/MF A01 CSCL 05B

The author has identified the following significant results. An increase in the data collection system's (DCS) ability to function in the flood control mission with no additional manpower was demonstrated during the storms which struck New England during April and May of 1975 and August 1976. It was found that for this watershed, creditable flood hydrographs could be generated from DCS data. It was concluded that an ideal DCS for reservoir regulation would draw features from LANDSAT and GOES. MSS grayscale computer printout and a USGS topographic map were compared, yielding an optimum computer classification map of the wetland areas of the Merrimack River estuary. A classification accuracy of 75% was obtained for the wetlands unit, taking into account the misclassified and the unclassified pixels. The MSS band 7 grayscale printouts of the Franklin Falls reservoir showed good agreement to USGS topographic maps in total area of water depicted at the low water reservoir stage and at the maximum inundation level. Preliminary analysis of the LANDSAT digital data using the GISS computer algorithms showed that the radiance of snow cover/vegetation varied from approximately 20 mW/sq cm sr in nonvegetated areas to less than 4 mW/sq cm sr for densely covered forested area.

N78-20575*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md. **THE SOLAR REFLECTANCE OF A SNOW FIELD**

B. J. Choudhury (Computer Sciences Corp.) and A. T. C. Chang Jan. 1978 25 p refs (NASA-TM-78085) Avail: NTIS HC A02/MF A01 CSCL 08L

The radiative transfer equation was solved using a modified Schuster-Schwartzschild approximation to obtain an expression for the solar reflectance of a snow field. The parameters in the reflectance formula are the single scattering albedo and the fraction of energy scattered in the backward direction. The single

scattering albedo is calculated from the crystal size using a geometrical optics formula and the fraction of energy scattered in the backward direction is calculated from the Mie scattering theory. Numerical results for reflectance are obtained for visible and near infrared radiation for different snow conditions. Good agreement was found with the whole spectral range. The calculation also shows the observed effect of aging on the snow reflectance. Author

N78-20576*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md. **PASSIVE MICROWAVE STUDIES OF SNOWPACK PROPERTIES**

D. K. Hall, A. T. C. Chang, J. L. Foster (Systems and Applied Sciences Corp.), A. Rango, and T. Schmugge Apr. 1978 15 p refs Presented at the Western Snow Conf., Otter Rock, Oreg., 18-20 Apr. 1978 (NASA-TM-78089) Avail: NTIS HC A02/MF A01 CSCL 08L

Microwave brightness temperatures were measured for the snowpacks at Walden and Steamboat Springs, Colorado during 1976 and 1977 aircraft experiments. Variations in measured brightness temperatures are attributed to snow grain and crystal sizes, liquid water content, and snowpack temperature. Results demonstrate that shorter wavelength radiation is scattered more strongly than longer wavelength radiation. J.M.S.

N78-20577*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md. **PILOT TESTS OF SATELLITE SNOWCOVER/RUNOFF FORECASTING SYSTEMS**

Albert Rango Mar. 1978 17 p refs Presented at 46th Ann. Western Snow Conf., Otter Rock, Oregon, 18-20 Apr. 1978 Sponsored in part by Geological Survey, Soil Conservation Service, Bureau of Reclamation, Bonneville Power Administration, Corps of Engineers, NOAA, California Dept. of Water Resources, Colorado Div. of Water Resources, and Arizona Salt River Project (NASA-TM-78109) Avail: NTIS HC A02/MF A01 CSCL 08L

Major snow zones of the western U.S. were selected to test the capability of satellite systems for mapping snowcover in various snow, cloud, climatic, and vegetation regimes. Different satellite snowcover analysis methods used in each area are described along with results. Author

N78-21339*# Texas A&M Univ., College Station. Remote Sensing Center. **ANALYSIS OF SYNTHETIC APERTURE RADAR IMAGERY Final Report, May 1976 - Jun. 1977**

Bruce J. Blanchard 10 Jun. 1977 40 p refs (Contract NAS5-23458) (NASA-CR-156743; RSC-3359-2) Avail: NTIS HC A03/MF A01 CSCL 17I

Some problems faced in applications of radar measurements in hydrology are: (1) adequate calibration of the radar systems and direct digital data will be required in order that repeatable data can be acquired for hydrologic applications; (2) quantitative hydrologic research on a large scale will be prohibitive with aircraft mounted synthetic aperture radar systems due to the system geometry; (3) spacecraft platforms appear to be the best platforms for radar systems when conducting research over watersheds larger than a few square kilometers; (4) experimental radar systems should be designed to avoid use of radomes; and (5) cross polarized X and L band data seem to discriminate between good and poor hydrologic cover better than like polarized data. Author

N78-21509*# Agricultural Research Service, Weslaco, Tex. **PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION Quarterly Progress Report, 1 Dec. 1977 - 1 Mar. 1978**

Craig L. Wiegand, Principal Investigator, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson Apr. 1978 7 p Sponsored by NASA ERTS (E78-10101; NASA-CR-155963) Avail: NTIS HC A02/MF A01 CSCL 08F

N78-21520* California Univ., Berkeley. Space Sciences Lab.

AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Semiannual Progress Report

Robert N. Colwell, Ralph Algazi, Leonard W. Bowden, John E. Estes, Ida R. Hoos, and Siamak Khorram, Principal Investigators
31 Dec. 1977 282 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Grant NGL-05-003-404)

(E78-10115; NASA-CR-156080; SSL-Ser-19-Issue-17) Avail: NTIS HC A13/MF A01 CSCL 08F

N78-21521* Environmental Research and Technology, Inc., Concord, Mass.

INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Progress Report, Jan. - Mar. 1978

James C. Barnes, Principal Investigator 12 Apr. 1978 5 p
Sponsored by NASA. ERTS
(E78-10116; NASA-CR-156081) Avail: NTIS HC A02/MF A01 CSCL 08H

N78-21539* Corps of Engineers, Baltimore, Md.
HYDRAULIC MODEL OF THE CHESAPEAKE BAY

Alfred E. Robinson, Jr. In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 111-121 refs
Avail: NTIS HC A17/MF A01 CSCL 08C

Preliminary planning for the formulation of the first year of hydraulic studies on the Chesapeake Bay model was recently completed. The primary purpose of this initial effort was to develop a study program that is both responsive to problems of immediate importance and at the same time ensure that from the very beginning of operation maximum economical use is made of the model. The formulation of this preliminary study plan involved an extensive analysis of the environmental, economic, and social aspects of a series of current problems in order to establish a priority listing of their importance. The study program that evolved is oriented towards the analysis of the effects of some of the works of man on the Chesapeake Bay estuarine environment.

Author

N78-21541* National Environmental Satellite Service, Washington, D. C.

REMOTE SENSING OF WATER QUALITY

Warren A. Hovis In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 141-148

Avail: NTIS HC A17/MF A01 CSCL 08H

Remote sensing from aircraft has been used to determine water content in areas such as the New York Bight. Extension of the techniques developed to satellite sensing of the Chesapeake Bay will begin in 1978 with the launch of Nimbus-G. Remote sensing offers a number of interesting possibilities for investigating a reasonably large body of water, such as the Chesapeake Bay, coupled with some disadvantages. The chief advantage of remote sensing is that it offers the opportunity to cover large areas in relatively short periods of time. Low altitude satellites traveling at about 7 km/s can cover the Chesapeake Bay in about 1 minute so that the entire Bay can be studied under almost identical conditions of solar illumination.

Author

N78-21544* Smithsonian Institution, Edgewater, Md. Chesapeake Bay Center for Environmental Studies.

RELATIONSHIP OF LAND USE TO WATER QUALITY IN THE CHESAPEAKE BAY REGION

David L. Correll In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 177-187 refs

Avail: NTIS HC A17/MF A01 CSCL 08H

Both the proportions of the various land use categories present on each watershed and the specific management practices in use in each category affect the quality of runoff waters, and the water quality of the Bay. Several permanent and portable stations on various Maryland Rivers collect volume-integrated water samples. All samples are analyzed for a series of nutrient, particulate, bacterial, herbicide, and heavy metal parameters. Each basin is mapped with respect to land use by the analysis of low-elevation aerial photos. Analyses are verified and adjusted by ground truth surveys. Data are processed and stored in the Smithsonian Institution data bank. Land use categories being investigated include forests/old fields, pastureland, row crops, residential areas, upland swamps, and tidal marshes. Author

N78-21545* Corps of Engineers, Baltimore, Md.

AN OVERVIEW OF DREDGING OPERATIONS IN THE CHESAPEAKE BAY

Ronald H. Silver In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 209-215 refs

Avail: NTIS HC A17/MF A01 CSCL 13B

Maintenance of the Baltimore and the Newport News/Norfolk harbors as well as of the Chesapeake and Delaware Canal is accomplished by different dredging operations which depend on the amount and type of material to be moved, water depth, and location of disposal sites. Methods for determining the physical or chemical-biological interactive effects of these activities on the environment and on the shellfish and finfish industries on the Bay are discussed. The types of dredges used are classed according to their mode of operation.

Author

N78-21551* Maryland Univ., Solomons. Center for Environmental and Estuarine Studies.

EUTROPHICATION IN THE CHESAPEAKE BAY

Robert E. Ulanowicz In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 269-273 refs

Avail: NTIS HC A17/MF A01 CSCL 08A

The advantages and limitations of using remote sensing to acquire fast reliable data on the nutrient problem in the Chesapeake Bay ecosystem are discussed. Pollution effects to phytoplankton blooms during late summer and early fall months are also considered.

J.A.M.

N78-21557* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ROLE OF REMOTE SENSING IN BAY MEASUREMENTS

John P. Mugler, Jr., John P. Godfrey, G. Daniel Hickman, Warren G. Hovis, Albin O. Pearson, and Kenneth N. Weaver In its Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 315-321

Avail: NTIS HC A17/MF A01 CSCL 14B

Remote measurements of a number of surface or near surface parameters for baseline definition and specialized studies, remote measurements of episodic events, and remote measurements of the Bay lithosphere are considered in terms of characterizing and understanding the ecology of the Chesapeake Bay. Geologic processes and features best suited for information enhancement by remote sensing methods are identified. These include: (1) rates of sedimentation in the Bay; (2) rates of erosion of Bay shorelines; (3) spatial distribution and geometry of aquifers; (4) mapping of Karst terrain (sinkholes); and (5) mapping of fracture patterns. Recommendations for studying problem areas identified are given.

J.M.S.

N78-21560* Virginia Inst. of Marine Science, Gloucester Point. Remote Sensing Section.

PROGRESS TOWARD A CIRCULATION ATLAS FOR APPLICATION TO COASTAL WATER SITING PROBLEMS

06 HYDROLOGY AND WATER MANAGEMENT

John C. Munday, Jr. and Hayden H. Gordon *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 345-358 refs

(Grant NGL-47-022-005)

(VIMS-Contrib-823) Avail: NTIS HC A17/MF A01 CSCL 08B

Circulation data needed to resolve coastal siting problems are assembled from historical hydrographic and remote sensing studies in the form of a Circulation Atlas. Empirical data are used instead of numerical model simulations to achieve fine resolution and include fronts and convergence zones. Eulerian and Lagrangian data are collected, transformed, and combined into trajectory maps and current vector maps as a function of tidal phase and wind vector. Initial Atlas development is centered on the Elizabeth River, Hampton Roads, Virginia. Author

N78-21570* National Aeronautics and Space Administration, Washington, D. C.

LANCHAD: REMOTE SENSING OF THE N'DJAMENA AREA AND THE LOGONE-CHARI CONFLUENT

C. Bardinet and J. M. Monget Apr. 1978 150 p refs Transl. into ENGLISH of "Teledetection de la Zone de N'Djamena et du Confluent Logone-Chari". Rept. Paris Univ., Ecole Normale Supérieure, Ecole Nationale Supérieure des Mines de Paris, and Université du Tchad, N'Djamena, Chad-Paris, Oct. 1977 p 1-114 Transl. by SCITRAN, Santa Barbara, Calif.

(NASA-TM-75087) Avail: NTIS HC A07/MF A01 CSCL 05B

The Republic of Chad's experimental beginnings of a program of earth resources inventory utilizing remote sensing from satellites. The program contemplates utilization of data from LANDSAT 1 and 2, NOAA, METEOSAT, and SPOT. Author

DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A78-21344 * The meaning of desert color in earth orbital photographs. F. El-Baz (Smithsonian Institution, Washington, D.C.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Jan. 1978, p. 69-75. 16 refs. Contract No. NAS9-13831.

The color of desert surfaces as seen in earth orbital photographs is indicative of soil composition. Apollo-Soyuz photographs of the Sturt and Simpson Deserts of Australia confirm that sand grains become redder as the distance from the source increases. Reddening is caused by a thin iron-oxide coating on individual sand grains and can be used, in some cases, to map relative-age zones. Photographs of the Western (Libyan) Desert of Egypt indicate three distinct and nearly parallel color zones that have been correlated in the field with: (1) arable soil composed of quartz, clay, and calcium carbonate particles; (2) relatively active sand with or without sparse vegetation; and (3) relatively inactive sand mixed with dark (desert-varnished) pebbles. The youngest sands are in the form of longitudinal dunes, which are migrating to the south-southeast along the prevailing wind direction. Some of the young dune fields are encroaching on the western boundary of the fertile Nile Valley. (Author)

A78-22012 # Soyuz 22 spacecraft and the MKF-6 multispectral camera of VEB Carl Zeiss JENA. A. Zickler. *Jena Review*, vol. 22, no. 6, 1977, p. 263-266.

The multispectral camera of the Soyuz 22, which took approximately 2000 multispectral photographs of the Soviet Union and the German Democratic Republic, is described. The six-channel imaging system employs nonoverlapping narrow-band color filters within the wavelength range of 480 to 840 nm. Designed for flying altitudes between 200 and 400 km, the camera provides imagery with an overlap of 20 to 80%. Correlation of individual photographs is discussed, and dynamic and thermal testing of the unit is mentioned. The imagery has proved valuable in such projects as a survey of the navigability of a tributary of the Lena River. J.M.B.

A78-22487 # The application of a mathematical modeling method for studying multispectral photographing (Primenenie metoda matematicheskogo modelirovaniia dlia issledovaniia protsessov mnogozonal'nogo fotografirovaniia). O. I. Anufriev and L. V. Zaletaev. *Geodeziia i Kartografiia*, Sept. 1977, p. 29-34. In Russian.

A method for determining the optimum spectral regions for multispectral photography is developed. It is based on the mathematical relationship between the magnitude of the spectral coefficient of object brightness and the value of the optical density of its representation on the spectral photograph. The maximum difference in the optical densities of the object and the background is used as a criterion for spectral region selection. S.C.S.

A78-22550 # Accuracy and consistency comparisons of land use and land cover maps made from high-altitude photographs and Landsat multispectral imagery. K. Fitzpatrick-Lins. *U.S. Geological Survey, Journal of Research*, vol. 6, Jan.-Feb. 1978, p. 23-40. 7 refs.

A78-22861 Digital processing of Landsat imagery to produce a maximum impression of terrain ruggedness. N. H. W. Donker and A. M. J. Meijerink (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal*, no. 4, 1977, p. 683-704.

Digital processing to produce a maximum impression of terrain relief from Landsat data is described; test areas in a limestone hill

region of Italy and in the Lesser Himalayas of India are used as samples. Comparison of intensity transformed Landsat data with calculated ideal radiances (Lambertian reflectance assumed) permits correction to obtain a good impression of relief. Furthermore, the application of histogram equalization to intensity transformed data provides a similar and much simpler technique for obtaining high relief. The principal component transform and the Euclidean distance technique, methods used for intensity transformation, are also discussed. J.M.B.

A78-23998 A clustering scheme for multispectral images. M. Goldberg (Ottawa, University, Ottawa, Canada) and S. Shlien (Canada Centre for Remote Sensing, Ottawa, Canada). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-8, Feb. 1978, p. 86-92. 31 refs. Research supported by the Canada Centre for Remote Sensing; National Research Council of Canada Grant No. A-4423.

A clustering algorithm based on the multidimensional histogram is proposed, and its operation on Landsat imagery is described. Clustering operations are done on the histogram to reduce computational effort and computer storage. The algorithm operates iteratively to isolate peaks in the histogram, which are then used to define clusters. A statistic is then introduced based on the log-likelihood ratio to measure the departure of a model from the observed data for multivariate Gaussian data. This statistic is used to measure the performance of a nonparametric clustering algorithm and can be used to choose between the different models found by the algorithm. For a small number of clusters, the statistic is shown to choose the model with the correct number of clusters. For a large number of clusters, an interactive mode of operation is necessary, which is illustrated on some Landsat imagery. P.T.H.

A78-26179 # A review of optical and digital synthetic aperture radar processing techniques. D. A. Ausherman (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: *Data Management Symposium*, Huntsville, Ala., October 18, 19, 1977, Proceedings. Huntsville, Ala., University of Alabama, 1978, p. 51-66. 15 refs.

Recent emphasis on the use of imaging SAR in remote sensing applications has spawned a renewed awareness of the need for efficient and economical image-formation processing technology. Both coherent-optical and digital techniques are being considered. This paper attempts to stimulate the debate over digital versus optical SAR processing methodologies by briefly restating the SAR principle and then giving a tutorial overview of the most utilized method associated with each processing medium. The tilted-plane processor is given as being representative of optical techniques. Although several viable digital approaches exist, only the direct-convolution method is discussed, since it represents the closest digital analog to the optical method. A comparison of the relative merits of the two processing media is given. (Author)

A78-26181 * # The Seasat algorithm development facility at JPL. J. W. Brown and R. A. Marks (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: *Data Management Symposium*, Huntsville, Ala., October 18, 19, 1977, Proceedings. Huntsville, Ala., University of Alabama, 1978, p. 81-90. 12 refs. Contract No. NAS7-100.

The Seasat-A spacecraft, scheduled for launch in May 1978, will produce a global ocean data set covering a one-year nominal mission. Because this is a proof-of-concept mission, data processing algorithms are expected to evolve as the data base grows. To support the evolution and evaluation of algorithms, and to experiment with various techniques for processing the data, an algorithm development facility (ADF) is being developed. The ADF will provide access to the data base and to highly modularized processing programs. The processing programs will be subject to easy and frequent modification by a remote user community of sensor managers and experiment teams, who will use this capability to evaluate the overall performance of the sensors and the algorithms using surface truth data. The ADF concepts of software standardization and interface control

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

are expected to have general applicability for adaptive data processing systems. (Author)

A78-26184 * # An image based information system - Architecture for correlating satellite and topological data bases. N. A. Bryant and A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Data Management Symposium, Huntsville, Ala., October 18, 19, 1977, Proceedings.

Huntsville, Ala., University of Alabama, 1978, p. 135-142. 14 refs.

The paper describes the development of an image based information system and its use to process a Landsat thematic map showing land use or land cover in conjunction with a census tract polygon file to produce a tabulation of land use acreages per census tract. The system permits the efficient cross-tabulation of two or more geo-coded data sets, thereby setting the stage for the practical implementation of models of diffusion processes or cellular transformation. Characteristics of geographic information systems are considered, and functional requirements, such as data management, geocoding, image data management, and data analysis are discussed. The system is described, and the potentialities of its use are examined. M.L.

A78-26186 # The ASTRO relational data base management system. H. Rubin, M. Anshel, J. Geller, C. Hamlin, D. Schilling, and S. Wecker. In: Data Management Symposium, Huntsville, Ala., October 18, 19, 1977, Proceedings. Huntsville, Ala., University of Alabama, 1978, p. 153-167.

The paper discusses design criteria used by Project ASTRO in designing a data base management system for Landsat data. The design criteria which led to the adoption of a relational data base management systems model are that: (1) the system must be capable of responding to queries whose logical structure was not foreseen at the time the system was constructed; (2) the system must exhibit data independence, in which user-determined changes in query structures, data storage, and output products can be installed without system modification; (3) the system must have a capacity for handling grid-cell and polygonal georeferenced data in conjunction with optical and tabular data types; (4) the system must have the ability to modify, update, renew, and delete data, with assurance that specified logical criteria are met; (5) the system must have the ability to perform operations while maintaining several levels of system security; and (6) the system must have flexibility in data storage protocols. M.L.

A78-26188 # Statistical synthesis of Landsat performance and methods for its enhancement. P. A. Castruccio (ECO Systems International, Inc., Gambrills, Md.). In: Data Management Symposium, Huntsville, Ala., October 18, 19, 1977, Proceedings.

Huntsville, Ala., University of Alabama, 1978, p. 179-200.

Statistical performance figures are synthesized from the results achieved in a 'universe' of more than 200 investigations from Landsat. Landsat performance is evaluated in two of the principal functions which underlie agricultural, land use and water resources applications: i.e., the functions of inventory and of mapping. Landsat performance is compared to the performance of conventional methods and against user requirements. A statistical theory is presented to explain the instances of good as well as of limited performance. A data interpretation method, based on this theory, is described which significantly enhances the performance level of interpretation of Landsat data and consequently its acceptability by the user. (Author)

A78-27762 Remote sensing - Statistical testing of thematic map accuracy. J. L. van Genderen, P. A. Vass (Fairey Surveys, Ltd., Maidenhead, Berks., England), and B. F. Lock (Salisbury College of Advanced Education, Adelaide, Australia). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 3-14. 13 refs.

Selection of the minimum sample size needed to guarantee a specified accuracy level in the interpretation of remote sensing data

is discussed. The sampling design incorporates the commonly-used stratified random procedure, though interpretation accuracy levels utilized are lower than those normally adopted for surveys based on aerial photograph interpretation. In particular, the statistical testing process takes into account the probability of making incorrect interpretations at prescribed accuracy levels, instead of merely expressing interpretation errors as a percentage of a subjectively derived number of sample sites. The technique is applied to the production of a land-use map for a region of Spain. J.M.B.

A78-27767 Vegetated coastal dunes - Growth detection from aerial infrared photography. J. E. Stembridge, Jr. (Coast Environmental Resources Institute, San Louis Obispo, Calif.). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 73-76. 8 refs. Research supported by the East Carolina University.

Aerial infrared photography is used to detect topographic changes in vegetation-induced sand dunes of the North Carolina Outer Banks. High infrared reflectance produced by the mutual interdependence of pioneer dune vegetation and wind-blown sand accumulation makes possible the prediction of dune growth and deflation patterns in vegetated coastal dune systems. (Author)

A78-27770 Cloud classification from visible and infrared SMS-1 data. J. Parikh (Maryland, University, College Park, Md.). *Remote Sensing of Environment*, vol. 7, no. 1, 1978, p. 85-92. Contract No. F44620-72-C-0062.

Pattern recognition systems are developed for cloud classification procedures employing visible and infrared data from the Synchronous Meteorological Satellite-1. Experiments involving both a four-class separation (low, mix, cirrus and cumulonimbus samples) and a three-class separation (low, cirrus and cumulonimbus samples) are reported. Classification accuracy for the four-class separation appears to decline by 4 to 11% when the same pattern recognition scheme is applied to two different data sets selected from the same satellite orbit; this decline in accuracy does not occur for the three-class separation. J.M.B.

A78-28248 # An 'optimal' filter for maps showing nominal data. S. C. Guptill. *U.S. Geological Survey, Journal of Research*, vol. 6, Mar.-Apr. 1978, p. 161-167. 12 refs.

An 'optimal' filtering technique for use with nominal data, such as land-use and land-cover categories, has been developed. This method is based on the conditional probability joins of neighboring data elements. In addition to its use in performing filtering, the method can be used to calculate the likelihood of each data element being properly classified. The technique was tested on a land-use data set for an area in Walnut Valley, Calif. The computer program performing the filtering process proved to be computationally efficient and produced satisfactory results. Useful statistics of the error estimation process were also generated. Future applications of the method to spectrally classified Landsat data are being explored. (Author)

A78-28386 The use of radar and multispectral imagery in the survey of an Atlantic coastal region /France/ (Utilisation des images radar et multispectrales dans la connaissance d'un milieu - Littoral Atlantique /France/). B. Fournier (Institut National Agronomique Paris-Grignon, Paris, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 141-152. 6 refs. In French.

Multispectral scanning imagery, in conjunction with side-looking radar observations, provides a useful assessment of the Atlantic coastal region of France, even during unfavorable atmospheric conditions. Spectral signatures for three regions are interpreted: marsh lands, dunes and plains. The application of the data to land management and agriculture is also discussed. J.M.B.

A78-28394 Study of a thermal plume in the Golfe de Fos (Étude d'un rejet thermique dans le Golfe de Fos). R. Burkhalter (Centre d'Études et de Recherches Géologiques et Hydrologiques, Montpellier, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1.

Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 305-346. In French.

The thermal plume arising in the Golfe de Fos (France) from an electric power plant was analyzed through use of aerial thermal mapping and remote sensing data processing techniques. Equipment tested for the aerial reconnaissance campaign included a variable-gain infrared scanner and a calibrated thermal imaging system. Data were presented in the form of densitometry readings or color visualizations. Sea-truth data were employed to calibrate the thermal imagery. J.M.B.

A78-28396 The identification and description of natural regions by photographs taken by stratospheric balloons (Connaissance et description de régions naturelles à partir de photographies prises de ballons stratosphériques). C.-M. Girard and M.-C. Girard (Institut National Agronomique Paris-Grignon, Paris, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 367-375, 15 refs. In French.

Photographs taken by stratospheric balloons yield a synthetic view of a region on a 1:400,000 scale. Enlargements to 1:200,000 permit the identification of landscape units which may then be described by geomorphology, hydrography, and various types of land use. The photographs are applicable to wide-scale mapping projects. S.C.S.

A78-28404 A comparison of images and multispectral classifications obtained by Landsat satellites, Skylab and the airborne Daedalus scanner (Comparaison des images et des classifications multispectrales obtenues à partir des satellites Landsat, Skylab et du scanner aéroporté Daedalus). A. Fontanel, C. Lallemand, G. Legendre, J. C. Rivereau, and G. Thomas (Institut Français du Pétrole, Rueil-Malmaison, Hauts-de-Seine, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 499-539. 8 refs. In French.

Landsat, S 192 Skylab and airborne scanner data obtained in Southern France are compared from a morphological point of view. A principal component analysis is conducted for each sensor in order to evaluate the information content of the two principal components and their usefulness for the interpreter. Then, multispectral classifications obtained with supervised and unsupervised techniques are discussed and compared with the different units found in the area under study. (Author)

A78-28407 Multispectral remote sensing of the coast of the Mont Saint-Michel bay (Télédétection multispectrale du littoral de la baie du Mont Saint-Michel). M. Albuissou, J. Dambricourt, A. Millou, J. M. Monget, Y. Thomas, and F. Verger. In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 649-662. In French. Centre National d'Études Spatiales Grant No. 76-222; Centre National de la Recherche Scientifique Grant No. RCP-353.

Using visible, near-infrared, and thermal infrared data, the coast of the Mont Saint-Michel bay was studied. In the case of thermographic data, noise caused by scanning and smoothing was accounted for. In the case of visible and near-infrared multispectral data, corrections were made for distortions, and unsupervised classification was performed. Plotters were used to obtain the colored cartographical visualization of results. S.C.S.

A78-29577 A two-camera intervalometer with a sampling option. P. I. van Eck and P. Bihuniak (Fisheries and Environment Canada, Northern Forest Research Centre, Edmonton, Alberta, Canada). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Mar. 1978, p. 285-287.

A two-camera intervalometer developed for large-scale photographic sampling is described; the device consists of a sequential intervalometer, a continuous intervalometer and a switching circuit. The two cameras, one equipped with a wide-angle lens and the other with a telephoto lens, yield two scales of photography which permit detailed terrain sampling. The intervalometer has proved effective in field testing during four seasons. J.M.B.

A78-29826 Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Symposium sponsored by the American Society of Photogrammetry and U.S. Geological Survey. Falls Church, Va., American Society of Photogrammetry, 1977. 420 p. \$10.00.

Remote sensing data acquisition, the interactive display and analysis of remote sensing data, classification schemes, preparation of maps, charts and graphic displays, and the costs and times involved in mapping from remote sensing data are discussed. Topics of the papers include Landsat-C processing, the Large Area Crop Inventory Experiment, the use of color infrared photography and Landsat data to assess flood damage, a comprehensive processing system to produce land resource maps, remote sensing of kelp, the remote monitoring of a strip mining operation, color lithographs from Landsat imagery, a digital laser printer for map production from Landsat data, and remote sensing maps of a subarctic ecology. J.M.B.

A78-29832 The EROS Digital Image Processing System /EDIPS/ - A complement to the NASA/GSFC Master Data Processor /MDP/. T. M. Ragland (U.S. Geological Survey, Reston, Va.) and P. Chavez, Jr. (U.S. Geological Survey, Flagstaff, Ariz.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 47-63.

When Landsat-C data becomes available, data processing will be performed by a complementary arrangement of the NASA/Goddard Space Flight Center Master Data Processor and the EROS Digital Image Processing System. The time between data acquisition and shipment to the user is expected to decrease, and the radiometric and geometric accuracy of the product will increase. A variety of user-requested digital enhancements may be applied to the data, and the products will be supplied in the form of 241 mm film or computer compatible tapes. J.M.B.

A78-29833 * Ground data handling for Landsat-D. T. J. Lynch (NASA, Goddard Space Flight Center, Information Extraction Div., Greenbelt, Md.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 64-70.

The present plans for the Landsat-D ground data handling are described in relationship to the mission objectives and the planned spacecraft system. The end-to-end data system is presented with particular emphasis on the data handling plans for the new instrument, the Thematic Mapper. This instrument generates ten times the amount of data per scene as the present Multispectral Scanner and this resulting data rate and volume are discussed as well as possible new data techniques to handle them - such as image compression. (Author)

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

A78-29835 Acquisition and application of Landsat data in ESCAP countries. S. A. Hempenius (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 85-90.

The article reviews the application of remote sensing activities in the member countries of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). Procedures for developing remote sensing programs in ESCAP countries are outlined. The introduction of airborne and satellite remote sensing is discussed along with dynamic surveying of agriculture, hydrology and coastal water phenomena. Reasons why many ESCAP countries have rejected the idea of a regional processing center for Landsat data are identified. The feasibility of establishing: (1) regional ground-receiving stations for real-time data acquisition, (2) regional data-processing centers, and (3) training facilities in the region is estimated. S.C.S.

A78-29838 * Integration of socioeconomic data and remotely sensed imagery for land use applications. N. A. Bryant and A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Image Processing Laboratory, Pasadena, Calif.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 120-130. 18 refs.

The Image Based Information System (IBIS) uses techniques of digital image processing to interface geocoded data sets, information management systems, thematic maps, and remotely sensed imagery. For two cases IBIS has been used to integrate remotely sensed imagery and socioeconomic data. In the first case thematically classified Landsat imagery covering Orange County, California is combined with census tracts and municipalities. In the second case, thematically classified Landsat imagery over Los Angeles, California is combined with census tracts. S.C.S.

A78-29840 Critical landform mapping of Alaska using radar imagery. P. J. Cannon (Alaska, University, Fairbanks, Alaska). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 144-160.

Radar imagery has been employed to map physiographic features in Alaska and to assess the effects of development on the environment. The frequent poor visibility and winter darkness in the state make radar the best means for remote sensing of this type. Samples of real-aperture X-band side-looking radar imagery from the Yakutat-Dry Bay area, the Arctic ice field west of Point Barrow, the Kotzebue region, and the foothills north of the Brooks Range are presented. Features mapped include glacial ice masses, alluvial materials, moraines of old glaciers and tidal flats. J.M.B.

A78-29844 Computer processing of Landsat MSS digital data for linear enhancements. P. S. Chavez, Jr., G. L. Berlin, and A. V. Acosta (U.S. Geological Survey, Computer Center Div., Flagstaff, Ariz.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 235-250. 10 refs.

Landsat Multispectral Scanner (MSS) digital image data covering southwestern Jordan and adjacent areas, were processed with special computer techniques designed to enhance linear forms in the images. Two types of processing were performed: image correction and image enhancement. Image correction procedures eliminated undesired artifacts and distortions from the digital data base. Image enhancement included spatial filtering designed to enhance large linears, and derivative techniques designed to enhance small linears. Both black and white images and multiple version color composites

were generated. Preliminary interpretation results showed numerous linears of various dimensions that were not identifiable on standard MSS image products or MSS computer enhanced images that were designed for lithology analyses. Several of the linears may indicate previously unmapped faults. (Author)

A78-29846 The role of the EROS Data Center - Present and future. A. H. Watkins (U.S. Geological Survey, Earth Resources Observation Systems Data Center, Sioux Falls, S. Dak.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 274-281.

The holdings of the Earth Resources Observation Systems Data Center include more than 800,000 frames of Landsat imagery, 50,000 frames of other spacecraft data, 1.5 million frames of data from NASA research aircraft, and an additional 3 million frames of aerial reconnaissance photography. These data are available in the form of color or black and white photographs and various types of computer compatible tapes. The assistance and training programs of the Data Center are described, and the conversion to all-digital processing at the launch of Landsat-C is mentioned. The availability of radiometrically and geometrically enhanced data is also discussed. J.M.B.

A78-29849 Sensor to symbol - Maps from satellite data. E. S. Schaller (Mead Technology Laboratories, Dayton, Ohio). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976. Falls Church, Va., American Society of Photogrammetry, 1977, p. 306-313.

A digital laser printer has been developed to prepare rapidly updated map products based on Landsat data. The printer accepts digital tapes and produces plates or color separation negatives; the output is similar to half-tone print screens. In addition, advanced ink-jet technology may be adopted for the creation of maps as large as 40 by 60 inches at the rate of several hundred per hour. J.M.B.

A78-30236 # Transfer of land use and land cover and associated maps into digital format. R. G. Fegeas and P. M. Kewer (U.S. Geological Survey, Reston, Va.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 55-66.

A78-30654 Simulation of synthetic aperture radar data film using holographic techniques. A. K. Aggarwal, P. C. Gupta, S. K. Mullick, and R. Subramanian (Indian Institute of Technology, Kanpur, India). *Applied Optics*, vol. 17, Apr. 1, 1978, p. 987-989. 9 refs.

Nonavailability of SAR system facilities may prevent access to data film (which is usually stored photographically), necessitating an optical simulation in the laboratory. A method is described which effects the simulation by means of a hologram generated with purely optical techniques. Coordinates of the wavefield are presented by a series of equations, outlining data generation for a single point scatterer. The approach is then extended to multiple point scatterers on the ground terrain. D.M.W.

A78-30707 * A quantitative study of the orientation bias of some edge detector schemes. E. S. Deutsch (State Electric Co., Ltd., Downsview, Ontario, Canada) and J. R. Fram (Finn and Fram, Inc., Sun Valley, Calif.). *IEEE Transactions on Computers*, vol. C-27, Mar. 1978, p. 205-213. 6 refs. Grant No. NGR-21-002-351.

The article discusses the orientational biases of various edge detection methods. On the basis of ERTS satellite images, three methods are compared: (1) Heuckel's local visual operator (1973), (2) Macleod's Gaussian edge mask detector (1972), and (3) Rosenfeld's local difference calculations (1971). The results yielded by these techniques are compared to the method for quantifying edge detector performance developed by Herskovits (1970). S.C.S.

N78-17257# Army Engineer Topographic Labs., Fort Belvoir, Va.

BACKSCATTERING OF RADAR WAVES BY VEGETATED TERRAIN Technical Report, May 1974 - Oct. 1975

Richard A. Hevenor Jun. 1977 99 p refs
(AD-A047669; ETL-0105) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report presents a vector theory for the backscattering of electromagnetic radar waves from vegetation. The basic technique employed in the solution required simulating the vegetation with a random medium. This medium possesses an electrical permittivity that is generated by a continuous random process and is characterized by a particular probability density function. A solution for the radar backscatter coefficient is obtained in terms of the statistical characteristics of the random medium. A comparison of the theory with experimental data is given. Insight is given into the nature of depolarization, but explicit results for the depolarized terms are not obtained at this time because of the complexity and difficulty of the solution. Some of the conclusions of this work are: a theory has been developed for computing the like polarized (HH and VV) radar backscatter coefficients from certain types of vegetation by using a vector renormalization approach; no rigorous quantitative comparison of theory with experiment was possible; however, qualitative comparisons indicate reasonable agreement; and although no explicit solution was obtained for the depolarization components, it was learned that one cause of depolarization is the anisotropy associated with the correlation function of the dielectric fluctuations. Author (GRA)

N78-17431* Geological Survey, Iowa City, Iowa.
LAND CLASSIFICATION OF SOUTH-CENTRAL IOWA FROM COMPUTER ENHANCED IMAGES Final Report
James R. Lucas (EROS Data Center, Sioux Falls, S. D.), James V. Taranik (EROS Data Center, Sioux Falls, S. D.), and Frederic C. Billingsley, Principal Investigators (JPL) Jul. 1977 288 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-20832)
(E78-10058; NASA-CR-155552) Avail: NTIS
HC A13/MF A01 CSCL 08B

The author has identified the following significant results. Enhanced LANDSAT imagery was most useful for land classification purposes, because these images could be photographically printed at large scales such as 1:63,360. The ability to see individual picture elements was no hindrance as long as general image patterns could be discerned. Low cost photographic processing systems for color printings have proved to be effective in the utilization of computer enhanced LANDSAT products for land classification purposes. The initial investment for this type of system was very low, ranging from \$100 to \$200 beyond a black and white photo lab. The technical expertise can be acquired from reading a color printing and processing manual.

N78-17432* Department of Industry, London (England).
ANALYSES OF THE CLOUD CONTENTS OF MULTISPECTRAL IMAGERY FROM LANDSAT 2: MESOSCALE ASSESSMENTS OF CLOUD AND RAINFALL OVER THE BRITISH ISLES Final Report
Eric C. Barrett and Colin K. Grant, Principal Investigators Jun. 1977 133 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(E78-10059; NASA-CR-155559) Avail: NTIS
HC A07/MF A01 CSCL 04B

The author has identified the following significant results. It was demonstrated that satellites with sufficiently high resolution capability in the visible region of the electromagnetic spectrum could be used to check the accuracy of estimates of total cloud amount assessed subjectively from the ground, and to reveal areas of performance in which corrections should be made. It was also demonstrated that, in middle latitude in summer, cloud shadow may obscure at least half as much again of the land surface covered by an individual LANDSAT frame as the cloud itself. That proportion would increase with latitude and/or time of year towards the winter solstice. Analyses of sample multispectral images for six different categories of clouds in summer revealed marked differences between the reflectance

characteristics of cloud fields in the visible/near infrared region of the spectrum.

N78-17435* Calspan Corp., Buffalo, N. Y.
IMAGE PROCESSING SYSTEM PERFORMANCE PREDICTION AND PRODUCT QUALITY EVALUATION Final Report
Eric K. Stein and Harry B. Hammill, Principal Investigators Apr. 1976 302 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-20366)
(E78-10062; NASA-CR-156654; ZE-5185-M-2) Avail: NTIS
HC A14/MF A01 CSCL 14E

The author has identified the following significant results. A new technique for image processing system performance prediction and product quality evaluation was developed. It was entirely objective, quantitative, and general, and should prove useful in system design and quality control. The technique and its application to determination of quality control procedures for the Earth Resources Technology Satellite NASA Data Processing Facility are described.

N78-17436* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NEAR EARTH PHOTOGRAPHS FROM THE APOLLO MISSIONS AND THE APOLLO-SOYUZ TEST PROJECT, PART 1
L. E. Giddings, Principal Investigator Aug. 1977 147 p refs EREP
(Contract NAS9-15200)
(E78-10063; NASA-CR-151585; LEC-11026-Pt-1; JSC-12947-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 14E

N78-17437* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NEAR EARTH PHOTOGRAPHS FROM THE APOLLO MISSIONS AND THE APOLLO-SOYUZ TEST PROJECT, PART 2
L. E. Giddings, Principal Investigator Aug. 1977 143 p refs EREP
(Contract NAS9-15200)
(E78-10064; NASA-CR-151586; LEE-11026-Pt-2; JSC-12947-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 14E

N78-17438* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NEAR EARTH PHOTOGRAPHS FROM THE APOLLO MISSIONS AND THE APOLLO-SOYUZ TEST PROJECT, PART 3
L. E. Giddings, Principal Investigator Aug. 1977 142 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-15200)
(E78-10065; NASA-CR-151587; LEC-11026-Pt-3; JSC-12947-Pt-3) Avail: NTIS HC A07/MF A01 CSCL 14E

N78-17439* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NEAR EARTH PHOTOGRAPHS FROM THE APOLLO MISSIONS AND THE APOLLO-SOYUZ TEST PROJECT, PART 4
L. E. Giddings, Principal Investigator Aug. 1977 143 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-15200)
(E78-10066; NASA-CR-151588; LEC-11026-Pt-4; JSC-12947-Pt-4) Avail: NTIS HC A07/MF A01

07: DATA PROCESSING AND DISTRIBUTION SYSTEMS

N78-17447* Missouri Univ., Rolla. Dept. of Mineral, Petroleum, and Geological Engineering.

TECHNIQUES FOR USING DIAZO MATERIALS IN REMOTE SENSOR DATA ANALYSIS

Lee E. Whitebay and Shara Mount Jan. 1978 21 p refs
(Contract NAS8-31767)
(NASA-CR-2953; M-246) Avail: NTIS HC A02/MF A01 CSCL 05B

The use of data derived from LANDSAT is facilitated when special products or computer enhanced images can be analyzed. However, the facilities required to produce and analyze such products prevent many users from taking full advantages of the LANDSAT data. A simple, low-cost method is presented by which users can make their own specially enhanced composite images from the four band black and white LANDSAT images by using the diazo process. The diazo process is described and a detailed procedure for making various color composites, such as color infrared, false natural color, and false color, is provided. The advantages and limitations of the diazo process are discussed. A brief discussion interpretation of diazo composites for land use mapping with some typical examples is included. Author

N78-17448* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT US STANDARD CATALOG Progress Report, 1-30 Nov. 1977

30 Nov. 1977 108 p
(NASA-TM-74998; GSFC/LU-C/011; NTISUB/C/138-011)
Avail: NTIS HC A06/MF A01 CSCL 05B

To provide dissemination of information regarding the availability of LANDSAT imagery, the Image Processing Facility (IPF), located at the Goddard Space Flight Center, publishes a U. S. and Non-U. S. Standard Catalog on a monthly schedule. These catalogs identify imagery which has been processed and input to data files during the referenced month. The U. S. Standard Catalog includes imagery covering the continental United States, Alaska, and Hawaii; the Non-U. S. Catalog identifies all the remaining coverage. Imagery adjacent to the continental U. S. and Alaskan borders will normally appear in the U. S. Standard Catalog. As a supplement to these catalogs, the LANDSAT imagery of one spectral band is available on 16mm microfilm.

Author

N78-17449* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT NON-US STANDARD CATALOG Progress Report, 1-30 Nov. 1977

30 Nov. 1977 69 p
(NASA-TM-74867; GSFC/LN-C/011; NTISUB/C/139-011)
Avail: NTIS HC A04/MF A01 CSCL 05B

The Non-U.S. Standard Catalog lists Non-U.S. imagery acquired by LANDSAT 1 and 2 which has been processed and input to the data files during the referenced month. Data, such as data acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given.

Author

N78-17450* National Aeronautics and Space Administration, Washington, D. C.

STATISTICAL MAPPING OF SHEET AIQUILE SE-20-9 (NATIONAL MAP) MAKING USE OF ERTS IMAGES

Jose Guillermo Torrez, Carlos E. Brockman, and Alvaro Fernandez Castro Aug. 1977 33 p refs Transl. into ENGLISH from Rev. Cartografica (Brazil), no. 26, 1974 p 127-158 Transl. by Transemantics, Inc., Washington, D.C.
(Contract NASw-2792)

(NASA-TM-75039) Avail: NTIS HC A03/MF A01

New possibilities of remote sensing by means of satellites to do research on natural resources are reported. These images make it possible to carry out integrated studies of natural resources in the shortest time possible and with small investments. Various maps and a complete description of each are included. With the use of these satellites, scientists can hopefully plan development projects at the national level.

Author

N78-18484* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

A MAXIMAL CHROMATIC EXPANSION METHOD OF MAPPING MULTICHANNEL IMAGERY INTO COLOR SPACE

Richard D. Juday and R. A. Abotteen, Principal Investigators Jan. 1978 13 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-15200)

(E78-10075; NASA-CR-151617; LEC-10830) Avail: NTIS HC A02/MF A01 CSCL 14E

The author has identified the following significant results. A color film generation method that maximally expands the chromaticity and aligns Kauth brightness with the gray axis was presented. In comparison with the current LACIE film product, the new color film product has more contrast and more colors and appears to be brighter. The field boundaries in the new product were more pronounced than in the current LACIE product. The speckle effect was one problem in the new product. The yellowness speckle can be treated using an equation. This equation can be used to eliminate any speckle introduced by the greenness. This product leads logically toward another that will employ quantitative colorimetry which will account for some of the eye's perception of color stimuli.

N78-18495* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. CLUSTER COMPRESSION ALGORITHM: A JOINT CLUSTERING/DATA COMPRESSION CONCEPT

E. E. Hilbert 1 Dec. 1977 160 p refs
(Contract NAS7-100)
(NASA-CR-155780; JPL-Publ-77-43) Avail: NTIS HC A08/MF A01 CSCL 05B

The Cluster Compression Algorithm (CCA), which was developed to reduce costs associated with transmitting, storing, distributing, and interpreting LANDSAT multispectral image data is described. The CCA is a preprocessing algorithm that uses feature extraction and data compression to more efficiently represent the information in the image data. The format of the preprocessed data enables simply a look-up table decoding and direct use of the extracted features to reduce user computation for either image reconstruction, or computer interpretation of the image data. Basically, the CCA uses spatially local clustering to extract features from the image data to describe spectral characteristics of the data set. In addition, the features may be used to form a sequence of scalar numbers that define each picture element in terms of the cluster features. This sequence, called the feature map, is then efficiently represented by using source encoding concepts. Various forms of the CCA are defined and experimental results are presented to show trade-offs and characteristics of the various implementations. Examples are provided that demonstrate the application of the cluster compression concept to multi-spectral images from LANDSAT and other sources.

Author

N78-18509* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CUMULATIVE NON-US STANDARD CATALOG Yearly Report, 1976 - 1977

1977 84 p
(NASA-TM-79359; GSFC/LN-77/013A; NTISUB/C/139-013A)
Avail: NTIS HC A05/MF A01 CSCL 05B

The LANDSAT 1 Non-U. S. Cumulative Catalog lists Non-U. S. imagery acquired by LANDSAT 1 which was processed and input to the data files during the referenced year. Data, such as date acquired, cloud cover, and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given.

Author

N78-18510* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CUMULATIVE US STANDARD CATALOG Yearly Report, 1976 - 1977

1977 179 p
(NASA-TM-79358; GSFC/LU-77/013A; NTISUB/C/138-013A)
Avail: NTIS HC A09/MF A01 CSCL 05B

The LANDSAT 1 U. S. Cumulative Catalog lists U. S. imagery acquired by LANDSAT 1 which was processed and input to the data files during the referenced year. Data, such as date acquired, cloud cover, and image quality are given for each scene. The microfilm and frame on which the scene may be found is also given. Author

N78-19554 Purdue Univ., Lafayette, Ind.
DATA COMPRESSION FOR BINARY AND MULTI-LEVEL SATELLITE IMAGERY Ph.D. Thesis

Po Hsiin Chen 1977 176 p
 Avail: Univ. Microfilms Order No. 77-30067

An efficient data compression system is presented for satellite pictures and two-level/multi-level pictures derived from satellite pictures. The compression techniques utilized correlation among adjacent picture elements. Several source coding methods were investigated. Double delta coding is presented and shown to be the most efficient of those discussed. Both the predictive differential quantizing technique and double delta coding were significantly improved by applying a background skipping technique. Several classes of codes representing the derived data resulting from the source coding techniques were examined. A prefix-extension code was constructed, which required very little storage space and operated efficiently. Simulation results are presented for various coding schemes and source codes.

Dissert. Abstr.

N78-19555* National Aeronautics and Space Administration.
 Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG, 1-31 DECEMBER 1977

Dec. 1977 70 p
 (NASA-TM-79367; GSFC/LU-C/012; NTISUB/C/138-012)
 Avail: NTIS HC A04/MF A01 CSCL 05B

The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N78-19556* National Aeronautics and Space Administration.
 Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG, 1-31 DECEMBER 1977

Dec. 1977 47 p
 (NASA-TM-79365; GSFC/LN-C/012; NTISUB/C/139-012)
 Avail: NTIS HC A03/MF A01 CSCL 05B

The non-U.S. Standard Catalog lists non-U.S. imagery acquired by Landsat 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N78-19561* Michigan State Univ., East Lansing. Agricultural Experiment Station.
GUIDE TO AERIAL IMAGERY OF MICHIGAN

William R. Enslin and Richard Hill-Rowley, Principal Investigators
 Nov. 1977 212 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
 (Grant NGL-23-004-083)
 (E78-10082; NASA-CR-155760; RR-340) Avail: NTIS HC A10/MF A01 CSCL 08B

N78-20562 Oregon Univ., Eugene.
AN INVESTIGATION INTO THE COMPARATIVE UTILITY OF COLOR INFRARED AERIAL PHOTOGRAPHY AND LANDSAT DATA FOR DETAILED SURFACE COVER TYPE MAPPING WITHIN CRATER LAKE NATIONAL PARK, OREGON Ph.D. Thesis

Stephen Joseph Walsh 1978 388 p
 Avail: Univ. Microfilms Order No. 7732070

Slope angle, slope aspect, and surface cover type variation, and to a lesser degree, crown size and crown density were the main environmental factors which accounted for spectral reflectance variation of surface cover types. Through an understanding of the influence of environmental factors in the reflectance value of surface cover types, the quality of training statistics and the location of training areas were evaluated in order to reduce misclassification or nonclassification possibilities. A regression analysis, analysis of variance, T values, F values, and beta values were used to determine the relative degree that certain environmental factors influenced the spectral reflectance of surface cover types producing a change in the mean reflectance of surface cover types per LANDSAT band.

Dissert. Abstr.

N78-20571* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

BAYESIAN CLASSIFICATION IN A TIME-VARYING ENVIRONMENT

Philip H. Swain 1 Mar. 1978 21 p refs
 (Contract NAS9-14970)
 (NASA-CR-151660; LARS-TR-030178) Avail: NTIS HC A02/MF A01 CSCL 12B

The problem of classifying a pattern based on multiple observation made in a time-varying environment is analyzed. The identity of the pattern may itself change. A Bayesian solution is derived, after which the conditions of the physical situation are invoked to produce a cascade classifier model. Experimental results based on remote sensing data demonstrate the effectiveness of the classifier. Author

N78-20574* Computer Sciences Corp., Huntsville, Ala. Aerospace Systems Center.

DIGITAL COMPUTER PROCESSING OF LANDSAT DATA FOR NORTH ALABAMA

A. D. Bond, R. J. Atkinson, M. Lybanon, and H. K. Ramapriyan
 Dec. 1977 285 p refs Original contains color illustrations
 (Contract NAS8-21805)
 (NASA-CR-2932; M-240) Avail: NTIS HC A13/MF A01 CSCL 05B

Computer processing procedures and programs applied to Multispectral Scanner data from LANDSAT are described. The output product produced is a level 1 land use map in conformance with a Universal Transverse Mercator projection. The region studied was a five-county area in north Alabama. Author

N78-20584* Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

PHOTOGRAMMETRIC METHODS FOR CREATION OF DIGITAL SITUATION MODELS [PHOTOGRAMMETRISCHE METHODE ZUR SCHAFFUNG DIGITALER SITUATIONS-MODELLE]

H. G. Neubauer In its Rept. on Mapping and Topographic Meas. 1977 p 83-89 In GERMAN; ENGLISH summary

Avail: NTIS HC A06/MF A01

A project on the digital evaluation of aerial photographs is reported. Studies carried out to create a digital model of planimetry for cartographic purposes are described and the requirements to be met by the procedure, the details of measurement, the subdivision of computations, and the design of documents for field comparison are considered. Author (ESA)

N78-20587* Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

DIGITAL IMAGE PROCESSING IN PHOTOGRAMMETRY. APPLICATION POSSIBILITIES FOR CARTOGRAPHIC PROBLEMS [DIGITALE BILDVERARBEITUNG IN DER PHOTOGRAMMETRIE. ANWENDUNGSMOEGLICHKEITEN FUER KARTOGRAPHISCHE AUFGABENSTELLUNGEN]

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

B. S. Schulz *In its* Rept. on Mapping and Topographic Meas. 1977 p 91-95 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A06/MF A01

The suitability of an edge extraction method for the data reduction of aerial photographs and its applicability to cartographic tasks are examined. Procedures based on this method are described and applied to image analysis and determination of the different natures of land use by means of digital image processing. Author (ESA)

N78-20738# Georgia Marine Science Center, Savannah.
GEORGIA'S COASTAL ZONE: AN INVENTORY OF PHOTOGRAPHIC AND SATELLITE COVERAGE 1945-1977
Robert J. Reimold and Ronald Keeler 1977 49 p Prepared in cooperation with Georgia Univ., Brunswick, Ga. (PB-275356/4; TR-77-5) Avail: NTIS HC A03/MF A01 CSCL 08B

The numerous aerial surveys and LANDSAT images that are available for the six coastal counties of Georgia are summarized. The aerial photographic surveys that were completed since 1945 are listed as well as the LANDSAT coverage of the region. The surveys are categorized by county and subclassified by date. Each of the entries identifies: (1) the date; (2) percentage of coverage of the county; (3) type of film; (4) scale; (5) agency that conducted the survey; (6) project identification number; and (7) map indicating the location of the flight. Entire surveys are enumerated. GRA

N78-21529*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRESENT STATUS OF LANDSAT REMOTE SENSING
Phillip J. Cressy *In its* Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 21-23

Avail: NTIS HC A17/MF A01 CSCL 08J

The state-of-the-practice of satellite remote sensing is examined. Emphasis is placed on the use of remote sensing to improve information gathering practices. Impediments to adopting this technology and opportunities to overcome these impediments are addressed. Author

N78-21535*# Environmental Protection Agency, Washington, D. C.
THE CHESAPEAKE BAY: A CHALLENGE TO THE REMOTE SENSING COMMUNITY
C. Eugene James *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 49-54

Avail: NTIS HC A17/MF A01 CSCL 08J

The use of remote sensing in studying, monitoring, and understanding the Chesapeake Bay was examined. References to multispectral scanning, laser techniques, infrared microwave, and radar were made. These aspects were then analyzed with multidimensional models, digital analysis, and holographic projections. Author

N78-21542*# National Oceanic and Atmospheric Administration, Rockville, Md. Engineering Development Lab.
ACOUSTIC REMOTE PROBING OF THE ENVIRONMENT
John A. Pijanowski *In* NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 149-156
Avail: NTIS HC A17/MF A01 CSCL 20A

Atmospheric acoustic probes located either at shore locations near the Chesapeake Bay or on large surface buoys could obtain profiles of wind velocity and turbulence and the temperature and humidity of the atmosphere. At or near the buoy locations, underwater probes located on the bottom could be used to profile current velocity, density, and turbulence and also to determine tide level, wave height, spectrum, and direction. The physical parameter profiles at these earth-surface stations could be used with surface observations by satellite. The most obvious use of data from such a network is to verify and calibrate models of energy exchange between the water of the Bay and the atmosphere. Author

N78-21562*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE USERS WORKSHOP REPORT
Richard E. Matthews, ed. 1978 300 p refs Conf. held at Houston, Tex., Aug. 1976 (NASA-CP-2030; S-476) Avail: NTIS HC A13/MF A01 CSCL 14B

The following topics were addressed: (1) Seasat land experiments; (2) program planning; (3) Synthetic Aperture Radar (SAR) data processing and (4) applications.

N78-21563*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY OF THE ACTIVE MICROWAVE USERS WORKSHOP
In its Active Microwave Users Workshop Rept. 1978 p 1-14

Avail: NTIS HC A13/MF A01 CSCL 14B

A coordinated microwave applications development program was initiated to improve the capability to: (1) identify, monitor, and assess the earth's resources; and (2) monitor the earth's environment and predict significant changes. The program consists of the scientific, technical, and programmatic activities required to develop microwave remote sensing into an operational tool for systematic earth observations. Author

N78-21564*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPLICATIONS OF ACTIVE MICROWAVE IMAGERY
F. P. Weber, Leo F. Childs, Richard Gilbert, J. C. Harlan, Roger Hoffer, John M. Miller, John Parsons, Fabian Polcyn, B. B. Schardt, James L. Smith et al *In its* Active Microwave Users Workshop Rept. 1978 p 15-48 refs

Avail: NTIS HC A13/MF A01 CSCL 14B

The following topics were discussed in reference to active microwave applications: (1) Use of imaging radar to improve the data collection/analysis process; (2) Data collection tasks for radar that other systems will not perform; (3) Data reduction concepts; and (4) System and vehicle parameters: aircraft and spacecraft. Author

N78-21565*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SEASAT LAND EXPERIMENTS
John E. Estes, Frank Barath, Nevin Bryant, P. J. Cannon, Charles Elachi, Alex Goetz, Kumar Krishen, Harold C. MacDonald, Allen Marmelstein, Leo J. Miller et al *In its* Active Microwave Users Workshop Rept. 1978 p 49-122 refs

Avail: NTIS HC A13/MF A01 CSCL 05B

An overview of the Seasat land experiments is presented. The potential roles for active microwave imaging systems on board satellites were reviewed with particular emphasis on the Seasat Synthetic Aperture Radar (SAR). Recommendations were made concerning the type of experiments that could most profitably be conducted over land with the Seasat SAR system capabilities available. Author

N78-21566*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACTIVE MICROWAVE USERS WORKING GROUP PROGRAM PLANNING
Fawwaz T. Ulaby, Janet Bare, W. E. Brown, Jr., Leo F. Childs, Louis F. Dellwig, John E. Heighway, Rigdon Joosten, Anthony J. Lewis, William Linlor, Jerry R. Lundien et al *In its* Active Microwave Users Workshop Rept. 1978 p 123-196 refs

Avail: NTIS HC A13/MF A01 CSCL 05A

A detailed programmatic and technical development plan for active microwave technology was examined in each of four user activities: (1) vegetation; (2) water resources and geologic applications, and (4) oceanographic applications. Major application areas were identified, and the impact of each application area in terms of social and economic gains were evaluated. The present

state of knowledge of the applicability of active microwave remote sensing to each application area was summarized and its role relative to other remote sensing devices was examined. The analysis and data acquisition techniques needed to resolve the effects of interference factors were reviewed to establish an operational capability in each application area. Flow charts of accomplished and required activities in each application area that lead to operational capability were structured. Author

N78-21567* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SYNTHETIC APERTURE RADAR (SAR) DATA PROCESSING

Frederick L. Beckner, Homer A. Ahr, Dale A. Ausherman, Lewis J. Cutrona, Sherman Francisco, Robert E. Harrison, Janeth S. Heuser, Rolando L. Jordan, Jim Justus, Bob Manning et al. *In its Active Microwave Users Workshop Rept.* 1978 p 197-277 refs

Avail: NTIS HC A13/MF A01 CSCL 05B

The available and optimal methods for generating SAR imagery for NASA applications were identified. The SAR image quality and data processing requirements associated with these applications were studied. Mathematical operations and algorithms required to process sensor data into SAR imagery were defined. The architecture of SAR image formation processors was discussed, and technology necessary to implement the SAR data processors used in both general purpose and dedicated imaging systems was addressed. Author

N78-21569* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. **EVALUATION OF LANDSAT MSS VS TM SIMULATED DATA FOR DISTINGUISHING HYDROTHERMAL ALTERATION**

Michael J. Abrams, Anne B. Kahle, Daryl P. Madura, and James M. Soha 1 Mar. 1978 55 p refs

(Contract NAS7-100)

(NASA-CR-156168; JPL-Pub-77-83)

Avail: NTIS

HC A04/MF A01 CSCL 05B

The LANDSAT Follow-On (LFO) data was simulated to demonstrate the mineral exploration capability of this system for segregating different types of hydrothermal alteration and to compare this capability with that of the existing LANDSAT system. Multispectral data were acquired for several test sites with the Bendix 24-channel MSDS scanner. Contrast enhancements, band ratioing, and principal component transformations were used to process the simulated LFO data for analysis. For Red Mountain, Arizona, the LFO data allowed identification of silicified areas, not identifiable with LANDSAT 1 and 2 data. The improved LFO resolution allowed detection of small silicic outcrops and of a narrow silicified dike. For Cuprite - Ralston, Nevada, the LFO spectral bands allowed discrimination of argillic and opalized altered areas; these could not be spectrally discriminated using LANDSAT 1 and 2 data. Addition of data from the 1.3- and 2.2- micrometer regions allowed better discriminations of hydrothermal alteration types. Author

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Includes data acquisition and camera systems and remote sensors.

A78-21802 # Airborne measurements of aerosol and sulfate concentration discontinuities in vertical and horizontal profiles. R. M. Brown and W. Garber (Brookhaven National Laboratory, Upton, N.Y.). In: Symposium on Atmospheric Turbulence, Diffusion, and Air Quality, 3rd, Raleigh, N.C., October 19-22, 1976, Preprints. Boston, Mass., American Meteorological Society, 1977, p. 340-343. 10 refs. ERDA-supported research.

A description is presented of some preliminary airborne measurements made during the past year in conjunction with a program for a study of several aspects of atmospheric pollution throughout the entire northeastern section of the U.S. The measurements considered included real-time vertical continuous particulate measurements to heights of 3000 meters over the meteorological tower at Brookhaven National Laboratory. It was found that, in general, a steady decrease in particle concentration exists as a function of height when near adiabatic temperature conditions prevail. Attention is also given to airborne horizontal transverse measurements made in 1975 along a line from New York City to Washington, D.C. in attempts to observe and measure concentration changes occurring downwind of several urban plumes along the flight path. G.R.

A78-22625 Reflected radiance measured by NOAA 3 VHR as a function of optical depth for Saharan dust. T. N. Carlson (Pennsylvania State University, University Park, Pa.) and P. Wendling (NOAA, Atmospheric Physics and Chemistry Laboratory, Boulder, Colo.). *Journal of Applied Meteorology*, vol. 16, Dec. 1977, p. 1368-1371. 8 refs. NSF Grants No. GATE-6319; No. GATE-6793.

Aerosol optical depth measured with sunphotometers at surface level and the VHR visible channel reflected intensity recorded by the NOAA-3 satellite were analyzed in a study of Saharan dust over the eastern tropical Atlantic Ocean. Clear sky brightness was determined from criteria based on histograms of brightness values in cloud-free areas of the satellite imagery. A near-linear relation between aerosol optical depth and the reflected radiance recorded by the satellite was obtained. J.M.B.

A78-24431 # Multispectral multichannel polarimeter and the microwave scatterometer experiment (Multispektral-Mehrkanal-Polarimeter und Mikrowellen-Scatterometer-Experiment). P. Heinecke and H. Klostermann (Dornier-System GmbH, Friedrichshafen, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Jahrestagung, 10th, Berlin, West Germany, Sept. 13-15, 1977, Paper 77-042*. 19 p. In German.

Consideration is given, in the first part of the work, to the systems design and operational characteristics of a multispectral multichannel polarimeter developed for application aboard Spacelab. The instrument, from 36 measurements of the linearly polarized component of earth-albedo radiation in 6 spectral ranges and at 4 discrete polarization angles, will be used to determine cloud water-content, the concentration of aerosol in the atmosphere, and plankton content in the oceans. In the second part of the work, attention is given to the microwave scatterometer experiment for the first Spacelab mission. The experiment incorporates the functions of two-frequency scatterometer for sea-state measurements, a radiometer for measurement of surface temperature and atmospheric attenuation, and a synthetic aperture radar. B.J.

A78-25806 # Some results of investigations of the earth atmosphere by radio thermal location. V. S. Troitskii, V. I. Aleshin, A. P. Naumov, V. M. Plechkov, V. A. Rassodovskii, M. I. Sumin, and

A. V. Troitskii (Nauchno-Issledovatel'skii Radiofizicheskii Institut, Gorki, USSR). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 23-25. 17 refs.

Earth atmosphere surveys involving the radio thermal location method are reported; the radiometric results provide information on atmospheric radio wave propagation near the H₂O and O₂ absorption resonance regions. Humidity and temperature height profiles are also derived from the data. Radio wave propagation characteristics, as well as temperature and humidity profiles, are obtained for cloudless conditions over the Atlantic Ocean and for the central European sector of the Soviet Union. J.M.B.

A78-25815 # Multiwavelength scintillation effects in a long-path CO₂ laser absorption spectrometer. A. G. Kjelaas, P. E. Nordal, and A. Bjerkestrand (Forsvarets Forskningsinstitut, Kjeller, Norway). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 71-76. 8 refs.

The noise properties of a rapidly switched two-wavelength CO₂ laser spectrometer are investigated in the framework of weak scattering turbulence theory; experiments involving laser beam propagation over a 600-m path to a small-aperture transmitter are also conducted. Particular attention is given to the effectiveness of the multiwavelength correlation technique for controlling scintillation noise in the long-path absorption spectrometer. Noise reduction through use of multiwavelength coherence is found to be dependent on similarity of the beam parameters and a small relative wavelength difference. J.M.B.

A78-25899 * # An empirical model for ocean radar backscatter and its application in inversion routine to eliminate wind speed and direction effects. G. J. Dome, A. K. Fung, and R. K. Moore (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 591-596. 7 refs. Contract No. NAS1-10048.

Several regression models were tested to explain the wind direction dependence of the 1975 JONSWAP (Joint North Sea Wave Project) scatterometer data. The models consider the radar backscatter as a harmonic function of wind direction. The constant term accounts for the major effect of wind speed and the sinusoidal terms for the effects of direction. The fundamental accounts for the difference in upwind and downwind returns, while the second harmonic explains the upwind-crosswind difference. It is shown that a second harmonic model appears to adequately explain the angular variation. A simple inversion technique, which uses two orthogonal scattering measurements, is also described which eliminates the effect of wind speed and direction. Vertical polarization was shown to be more effective in determining both wind speed and direction than horizontal polarization. B.J.

A78-25900 * # Comparisons of some scattering theories with recent scatterometer measurements. A. K. Fung, G. Dome, and R. K. Moore (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 597-602. 15 refs. Contract No. NAS1-10048.

The paper compares the predictions of two different types of sea scatter theories with recent scatterometer measurements which indicate the variations of the backscattering coefficient with polariza-

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tion, incident angle, wind speed, and azimuth angle. Wright's theory (1968) differs from that of Chan and Fung (1977) in two major aspects: (1) Wright uses Phillips' sea spectrum (1966) while Chan and Fung use that of Mitsuyasu and Honda, and (2) Wright uses a modified slick sea slope distribution by Cox and Munk (1954) while Chan and Fung use the slick sea slope distribution of Cox and Munk defined with respect to the plane perpendicular to the look direction. Satisfactory agreements between theory and experimental data are obtained when Chan and Fung's model is used to explain the wind and azimuthal dependence of the scattering coefficient. B.J.

A78-25902 # Remote sensing of the ocean surface by multispectral microwave radiometry. L. Thrane (Danmarks Tekniske Højskole, Lyngby, Denmark). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 609-614, 15 refs.

Numerical models of sea, atmosphere and radiometer are combined to provide a total systems model, representing a multispectral passive microwave radiometer system, the sensitivities of which are sufficient for accurate determination of sea surfaces and wind speeds. It is shown that if the measurement inaccuracies and the model uncertainties are Gaussian distributed, an optimal nonlinear processing scheme may be devised for estimating the sea surface temperature, salinity and wind speed. Several approximate linear and nonlinear processing methods are described. Computed performance parameters indicate that ocean surface temperature estimation can be made with an accuracy of 1.6 Kelvin and that wind speed determinations to within 2 m/s are feasible in more than 90 percent of the rainy August-September period. B.J.

A78-25905 # Marine boundary layer observations by microwave radiometers. C. I. Beard and L. U. Martin (U.S. Navy, Naval Research Laboratory, Washington, D.C.). In: Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977, p. 631-636, 10 refs.

An experiment in 1975 showed that 22-GHz radiometers could detect and localize in height internal waves on an atmospheric inversion layer in a marine environment. The present paper describes a 1976 experiment conducted off the Point Loma Peninsula, San Diego, Calif., in which much finer atmospheric structure was observed with two narrow (3 deg beamwidth) beams. An example is the first detection and correlation between two radiometer beams of short-period K-H waves. Radiometer sensitivities to inversion height changes were found to be the same whether a solid stratus layer was present or not, and averaged approximately 25 m/deg K, a rather sensitive value. An example of a train of long (10-11 min) period waves is presented to show unusual behavior; the radiometer undulations flipped in and out of phase with the microbarograph pressure fluctuations at times when the internal wave propagation directions changed, three or four principal wave directions found to recur throughout the 5.5-hour wave train. B.J.

A78-26297 * Diffuse-direct ultraviolet ratios with a compact double monochromator. L. M. Garrison, L. E. Murray, D. D. Doda, and A. E. S. Green (Florida, University, Gainesville, Fla.). *Applied Optics*, vol. 17, Mar. 1, 1978, p. 827-836, 33 refs. Research supported by the Dow-Corning Corp.; Contract No. NAS5-22908.

An improved system has been implemented for measuring the ratio of the diffuse skylight to the direct sunlight in the biologically active region of the UV near the atmospheric limit. It combines a double monochromator employing holographic gratings for reduction of stray light with a cooled photomultiplier tube to provide a greatly improved SNR below 300 nm. Data may be obtained in either a scan mode or a narrowband photometry mode; in the latter mode accurate ratios have been obtained near 290 nm. Representa-

tive data are discussed along with a theoretical model of the ratio. The system is compact enough for use in a mobile monitoring system. (Author)

A78-26550 # Telecommunications equipment for Meteosat mission. M. Lambourg (Laboratoire Central de Télécommunications, Velizy-Villacoublay, Yvelines, France). *Electrical Communication*, vol. 52, no. 4, 1977, p. 299-302.

Consideration is given to the Meteosat system which consists of radiometric imaging of the earth, the collection of meteorological and environmental data, and the dissemination of meteorological data. The ground station infrastructure has user and central stations for telecommunications and control, data processing, receiving in the 1700 MHz band, and data collection platforms. Each data collection platform consists of subassemblies for (1) containing sensors and handling data, and (2) containing telecommunications equipment for data transmission. Messages are relayed by Meteosat to the data acquisition, tracking, and telecommunications station from which they are retransmitted to users. Prototypes of the system have been designed and tested, and a model has been selected for mass production. S.C.S.

A78-26753 # Ultrasonic method of measuring elastic constants of liquids as a function of pressure and temperature (Ultradźwiękowa metoda pomiaru stałych sprężystości cieczy w funkcji ciśnienia i temperatury). Z. Kozłowski, W. Szachnowski, and B. Wislicki. *Instytut Lotnictwa, Prace*, no. 69-70, 1977, p. 31-47, 20 refs. In Polish.

The speed of propagation of ultrasound in liquid petroleum products as a function of pressure and temperature was measured in the pressure range 0-2200 kgf/sq cm and temperature range -60-80 C. Pulse-phase mechanically tuned and electronically tuned interferometers are described along with the other measuring equipment, including the thermostat system. Measurement results were used to calculate the isentropic compression modulus, the compression coefficient, the relative compressibility, density, and impedance. The complete measurement results for Hydrol 40 oil are given. P.T.H.

A78-28014 The measurement of the absolute value and the variations of the geomagnetic field with proton and optical pumping magnetometers. III - The absolute measurement of the geomagnetic vector: Automatic stations (La medida del valor absoluto y variaciones del campo geomagnético con magnetómetros de protones y bombeo óptico. III - La medida absoluta del vector geomagnético: Estaciones automáticas). M. Catalán and F. Gómez Armario. *Urania* (Madrid), vol. 61, Jan.-June 1976, p. 111-162, 64 refs. In Spanish.

The design of systems for automatically measuring the absolute value of the geomagnetic vector is considered, with attention given to systems involving proton vector and optical pumping magnetometers. Calibration of a variometer, and automatic registration of geomagnetic field values in digital form are considered. A FORTRAN program implemented at an automatic geomagnetic field monitoring station is described, and error corrections adopted for the program are discussed. J.M.B.

A78-28040 # Models of the magnetic field in earth's magnetosphere (Model'nye predstavleniia magnitnogo polia v magnetosfere zemli). A. E. Antonova. *Geomagnitnye Issledovaniia*, no. 20, 1977, p. 68-73, 33 refs. In Russian.

Several quantitative models of the geomagnetic field based on theoretical concepts as well as on experimental data are reviewed. Characteristics of the field structure in the magnetosphere are examined which play an important role in the interpretation of ground-based observations and their relation to magnetospheric processes. Some results are discussed for a geomagnetic-field study using a two-dipole model of the magnetosphere. These results are compared with those obtained from other models and with experimental data. F.G.M.

A78-28379 Remarks on the meaning of remote sensing data (*Réflexions sur la signification des données de télédétection*). P. Rey (Toulouse III, Université, Toulouse, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 55-58. In French.

The successful interpretation of spectral signatures in remote sensing data needs to rely on more than simplistic ground-truth criteria commonly in use at present. In fact, the spectral signature of a feature (especially vegetation) gives not only information on the morphology of the structure and the time-varying or seasonally-changing attributes of the object, but also information on subtler qualities due to the environment of the feature. These subtler qualities include physical and physiological responses to temperature, light, humidity, aeration, evapotranspiration and soil depth. J.M.B.

A78-28395 The detection of hydrocarbon sheets on the sea (*La détection des nappes d'hydrocarbures sur la mer*). A. Fontanel (Institut Français du Pétrole, Rueil-Malmaison, Hauts-de-Seine, France) and A. Roussel (Centre National pour l'Exploitation des Océans, Paris, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 347-365. 6 refs. In French.

Photographic emulsions, visible and infrared scanners, passive radiometers, as well as real- and synthetic-aperture side-looking radar systems are assessed in terms of their capability for remotely detecting oil spills in the ocean. Several types of heavy petroleum and diesel fuel are subjected to trial detection, and emissivity data for the various substances in water are presented. The difficulty of discriminating between petroleum spills and fish-processing refuse is also mentioned. J.M.B.

A78-28406 First results concerning the use of multispectral data for studying bathymetric features of Mediterranean lagoons (*Premiers résultats concernant l'utilisation des données multispectrales pour l'étude bathymétrique des lagunes Méditerranéennes*). P. Olivon (Centre d'Etudes et de Recherches Géodynamiques et Astronomiques, Montpellier; Ecole Pratique des Hautes Etudes, Paris, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 2. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 597-647. 14 refs. In French.

Multispectral remote sensing techniques are applied to investigations of bathymetric features of several Mediterranean lagoons. Methods for depth determination are discussed within the limits of the optical properties of water. Results obtained by Landsat digital data in the Languedoc region and on the coast of Corsica are presented; supervised and unsupervised cartography are discussed. It is noted that in multispectral remote sensing, the number of bands analyzed must be sufficient to account for undesirable components associated with the color of the sea. It is suggested that Daedalus recordings may be applicable to such a study. S.C.S.

A78-30141 The spin scan camera system - Geostationary meteorological satellite workhorse for a decade. V. E. Suomi and R. J. Krauss (Wisconsin, University, Madison, Wis.). *Optical Engineering*, vol. 17, Jan.-Feb. 1978, p. 6-13.

The spin-scan camera was first flown on ATS-1 from 1966 to 1973 to monitor continuously the global atmospheric circulation. Later, modified versions with improved sensor capabilities were flown on ATS-3 and SMS. Today, the GOES series of spin-scan cameras is in regular operational use. The value of the spin-scan camera as a dependable meteorological workhorse requires proper functioning of the entire camera system, composed of four main elements: (1) a spinning spacecraft whose highly stable and predictable motions generate a time-divisible precision scan and therefore a metric image; (2) a telescope having both on-axis image quality and a wide field of view; (3) a data chain which incorporates duty-cycle improvement and uses the spacecraft as a communication link to

distribute the image data to users; and (4) image display and analysis techniques which permit organizing a large number of images in the time domain and efficiently selecting and measuring data of greatest importance. (Author)

A78-30142 * Limb Infrared Monitor of the Stratosphere (LIMS) experiment. R. W. Drozewski and M. R. Hatch (Honeywell Electro-Optics Center, Lexington, Mass.). *Optical Engineering*, vol. 17, Jan.-Feb. 1978, p. 14-22. Contract No. NAS1-13799.

The Limb Infrared Monitor of the Stratosphere (LIMS) radiometer is a satellite-borne six-channel multispectral scanning radiometer using a two-stage methane and ammonia solid-cryogen cooler to cool the (Hg, Cd)Te focal plane to 65 K. The LIMS experiment employs thermal IR limb sounding to provide vertical-profile measurement of temperature and of concentrations of O₃, NO₃, and H₂O in the stratosphere on a global scale. The goals of the experiment and the expected accuracies of the measurements are outlined, and the radiance measured by the radiometer is analyzed. A program of correlative measurements designed for verification and augmentation of the LIMS data is discussed. Detailed descriptions are given of the LIMS components and optics, the detector capsule assembly, the solid-cryogen cooler, the four operational modes of the LIMS system, and the data-processor electronics. It is noted that prelaunch acceptance testing thus far completed indicates that the LIMS specification design requirements have been met, and the experiment's performance goals can be achieved. F.G.M.

A78-30143 Lidar in space. R. T. H. Collis, R. D. Hake, P. B. Russell (SRI International, Menlo Park, Calif.), and S. A. Bowhill (Illinois, University, Urbana, Ill.). *Optical Engineering*, vol. 17, Jan.-Feb. 1978, p. 23-29. 54 refs.

The lidar (laser radar) technique of remotely observing atmospheric structure and composition is ready for use on a space vehicle. The Spacelab program provides an ideal facility for initiating and exploring this concept, since it makes development possible on a short-trip minimum-investment basis. The goals, philosophy, and rationale of a proposed program to accomplish the first use of lidar in space are described, and details are provided of the specific observations proposed and of the necessary instrumentation. Using a solid-state neodymium laser frequency-doubled to drive a tunable doubled dye laser, energy could be transmitted in a range of wavelengths. With simple wavelength-discriminating photometric detectors the system could be used to detect returns from particles (cloud and dust) or Na atoms or Mg(+) ions. (Author)

A78-30145 Airborne Fourier transform spectroscopy of the upper atmosphere. W. G. Mankin (National Center for Atmospheric Research, Boulder, Colo.). *Optical Engineering*, vol. 17, Jan.-Feb. 1978, p. 39-43. 8 refs.

High-resolution infrared spectroscopy is a very useful technique for remote sensing of atmospheric constituents. From an aircraft it is possible to use emission or absorption spectroscopy to measure total quantities of constituents above the aircraft or profiles at altitudes below the flight. The adaptation of a commercial high-resolution (0.06 kaysers) Fourier-transform infrared spectrometer for use in absorption spectroscopy on a jet aircraft is described, emphasizing methods of dealing with the difficulties of the aircraft environment. Atmospheric constituents with concentrations less than one part per billion can be measured. (Author)

A78-30146 * Atmospheric monitoring using heterodyne detection techniques. R. T. Menzies (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Optical Engineering*, vol. 17, Jan.-Feb. 1978, p. 44-49. 15 refs. Contract No. NAS7-100.

Both passive and active remote-monitoring instruments using discretely tunable infrared gas lasers and heterodyne receivers have been used for measurements of ozone and other trace constituents in

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the atmosphere. A ground-based solar heterodyne radiometer has been used in discrete spectral regions near 9.5 microns to measure altitude profiles of ozone in both the troposphere and stratosphere. Results indicate that this technique shows promise in providing calibration points for earth-orbiting ozone-measurement instruments. An airborne laser absorption spectrometer has been used to measure tropospheric ozone in two series of flights during the winter and spring of 1977, and these operations are described. Plans are also in progress to fly a balloon-borne heterodyne radiometer during the fall of 1977 in order to measure stratospheric trace species. (Author)

A78-30238 # Computer-aided mapping of land use and land cover using Landsat multispectral scanner data. R. A. Ellefsen, R. A. Ennis, L. J. Gaydos, L. A. Morrissey, W. L. Newland, G. P. Thelin, and J. R. Wray. *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Oct. 1977, p. 84-102.

Computer-aided production of land use and land cover maps from Landsat digital data is discussed; conversion of spectral classes to land cover classes and the use of lineprinter (digital) mapping techniques are considered. One of the advantages of lineprinter mapping is its usefulness for detecting environmental changes. For example, lineprinter maps have been instrumental in monitoring the expansion of mobile home parks. Other applications of computer-aided land use mapping have included preparation of thematic maps for the Washington, D.C. area, and the development of a Pacific Northwest land cover survey. J.M.B.

A78-31121 # A fast infrared interferential spectrometer for the systematic observation of sites (Spectromètre interférentiel infrarouge rapide pour l'observation systématique des sites). G. Gauffre (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). (*European Space Agency and Centre National d'Etudes Spatiales, Colloque International sur l'Observation Spatiale de la Terre et la Gestion des Ressources Planétaires, Toulouse, France, Mar. 6-11, 1978.*) ONERA, TP no. 1978-15, 1978. 7 p. In French.

A Fourier-transformation spectrometer with a sensitivity in the 3.3- to 12.5-micron range has been developed for the observation of infrared sources whose temperatures are near the ambient temperature. The infrared spectrometer is a rapid-scanning device capable of completing a spectrum analysis in 0.1 second; a reference black body included in the equipment is employed in the differential-mode analysis performed by the spectrometer. An excellent thermal resolution, together with the high data acquisition rate, makes the device well suited to the measurement of fluctuations inherent in radiation sources or provoked by atmospheric turbulence. J.M.B.

A78-31374 A study of two polar magnetic substorms with a two-dimensional magnetometer array. J. R. Bannister and D. I. Gough (Alberta, University, Edmonton, Canada). *Geophysical Journal*, vol. 53, no. 1, Apr. 1978, p. 1-26. 20 refs. Research supported by the National Research Council of Canada, University of Alberta, Carnegie Institution of Washington, and Organization of American States.

A two-dimensional array of 23 three-component magnetometers located beneath the auroral oval in western Canada provided information on the three-dimensional magnetospheric-ionospheric currents that resulted in the polar magnetic substorms of September 7 and 18, 1974. Current density distributions were modeled at six representative epochs of the substorms through use of Oldenburg's (1976) inverse method. The principal ionospheric current was westward, though significant eastward current was also noted north of the westward electrojet. Bends in the ionospheric current segments toward the northwest appeared to follow the auroral oval in some cases, though in other instances they may have been associated with the Harang discontinuity. J.M.B.

A78-31908 * # Onboard magnetic field modeling for Solar Maximum Mission /SMM/. R. D. Headrick and F. L. Markley (Computer Sciences Corp., Silver Spring, Md.). *American Astronautical Society and American Institute of Aeronautics and Astronautics, Astrodynamics Specialist Conference, Jackson Hole, Wyo., Sept. 7-9, 1977, Paper. 19 p. 6 refs. Contract No. NAS5-11999.*

Analysis and simulation results are presented for magnetic field models for use in attitude acquisition onboard Solar Maximum Mission (SMM). A study was made of the degree of the spherical harmonic expansion of the magnetic field required, considering mission requirements, modeling errors, and magnetometer quantization and biases. It is shown that a fifth-degree field is sufficient to provide two-degree roll angle determination accuracy with a residual magnetic bias of 10 milligauss. Also, a spherical harmonic expansion for the McIlwain L-parameter is included for the first time. This parameter will be telemetered to ground with experimental data. The fifth-degree expansion will provide the L-parameter to within two percent of accepted values. The additional onboard computational burden is the storage of 36 coefficients and an increase of about 15% in computation time. Prototype flight code was developed which is anticipated to require about 2000 bytes of core storage and 30 milliseconds of computation time per orbit point on the NSSC-1 computer. (Author)

A78-32218 Ozone forecasting using empirical modeling. G. H. Revlett (Kenvirons, Inc., Frankfort, Ky.). *Air Pollution Control Association, Journal*, vol. 28, Apr. 1978, p. 338-343. 13 refs.

An ozone forecasting model using a statistically derived approach is presented. Since the model is very site specific, a major goal was to establish the techniques which can be used to develop an ozone forecasting model for specific monitoring networks. The development of the model for the ozone monitor at Newport, Kentucky is described; the highest correlated parameters, the relationships of individual parameters, and the empirical constant are determined, linear equations are combined, and the accuracy of the final empirical equation and its need for refinement are examined. Although errors as high as 25% occurred, the typical error in forecasting was in the 5-10% range. M.L.

A78-32390 Rectification of multispectral scanner imagery. K. Kraus (Wien, Technische Universität, Vienna, Austria). (*Bildmessung und Luftbildwesen*, vol. 43, July 1, 1975, p. 129-134.) *Photogrammetric Engineering and Remote Sensing*, vol. 44, Apr. 1978, p. 453-457. 13 refs. Translation.

Multispectral scanning systems make it possible to record the radiation characteristics of the scanned terrestrial surface in several spectral ranges. The radiation-intensity data which are first recorded on magnetic tape, are subsequently represented in the form of photographic pictures. Current limitations regarding the utilization of these pictures could be overcome with the aid of a suitable correction procedure. Details for such a procedure are discussed, taking into account its application in a specific example. The described procedure involves a digital optical differential process. G.R.

A78-32396 * A spectroradiometer for airborne remote sensing. H.-Y. Chiu (NASA, Goddard Institute for Space Studies, New York, N.Y.) and W. Collins (NASA, Goddard Institute for Space Studies; Columbia University, New York, N.Y.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Apr. 1978, p. 507-517. 11 refs. NASA-supported research.

A remote sensing system for use in light aircraft is discussed with attention to its applications in measuring geologic zones of alteration, vegetation canopies, and the spectral properties of water bodies. A parallel electro-optical input spectroradiometer configuration with 500 channels operating in the 400-1100 nm region is described. A resolution of 18 meters square from an altitude of 600 m at 200 kmh is obtained with 4-digit spectral radiance data at 2.5 spectra/sec on a 9-track tape in computer compatible format. D.M.W.

N78-17097* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STRATOSPHERIC AEROSOL MEASUREMENTS: EXPERIMENT MA-007

T. J. Pepin (Wyoming Univ.), M. P. McCormick, W. P. Chu (Old Dominion Univ.), F. Simon (Wyoming Univ.), T. J. Swissler (Systems and Applied Sciences Corp.), R. R. Adams, K. H. Crumby, and W. H. Fuller, Jr. In NASA. Johnson Space Center. Apollo-Soyuz Test Proj., Vol. 1 1977 p 127-136 refs

Direct solar occultation measurements by photometers and from photographs are used for defining stratospheric aerosol concentrations. Ground truth data provided by laser radar and balloon-borne dustsonde are combined with the remote sensing data from the experiment to investigate the uniqueness of aerosol optical models. The results show a 1.5 times higher peak aerosol concentration in the Northern Hemisphere than in the Southern Hemisphere. Author

N78-17451# Lockheed Missiles and Space Co., Palo Alto, Calif. **MULTIZONAL PHOTOGRAPHS FROM SPACE**

L. A. Vedeshin [1978] 17 p Transl. into ENGLISH from Priroda (USSR), no. 10, 1977 p 93-104
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The use of multizonal space-borne photography was examined as utilized in the U.S.S.R./G.D.R. space program. The photographic apparatus, MKF-6, was developed and tested as part of the Raduga experiment on Soyuz 22. Earth was successfully studied from space using aerial cosmic facilities. Space photographs obtained are of value in extensive studies of the socialist nations national economy. B.L.P.

N78-17455# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.

INVESTIGATION ON THE APPLICATION OF MULTISPECTRAL SCANNING [ONDERZOEK NAAR DE TOEPASSINGSMOGELIJKHEDEN VAN MULTISPECTRALE SCANNING]

N. J. J. Bunnik, W. Verhoef, D. Uenk, H. W. J. VanKasteren, T. A. DeBoer, M. C. Bronsveld, I. S. Zonneveld, P. Faber, J. Luitjes, J. VdToorn et al Mar. 1977 381 p refs In DUTCH Original contains color illustrations
(NIWARS-Publ-44) Avail: NTIS HC A17/MF A01

The airborne multispectral scanning (MSS) technique was investigated with special application to vegetation, geology, and water management. Three test flights were made by CNES/GDTA from May 1975 to March 1976, using a Daedalus DS-1250 ten channel MSS, a Daedalus DS-1230 two channel thermal IR scanner, and a wild RC-8 camera with IRC diapositive emulsion. The MSS data were compared with false color photographs. It was found that because of the large resolving power of MSS, both for the wavelength spectrum and for the intensity of the reflected radiation, very slight vegetation differences can already be detected. For geology, aerial photographs and IR images are thought to be more effective. For water householding purposes, so far investigated only for outer dyke areas, MSS gave appreciably more information than false color photographs. ESA

N78-17457# Lockheed Electronics Co., Inc., Las Vegas, Nev. Remote Sensing Lab.

GUIDE TO PRESELECTION OF TRAINING SAMPLES AND GROUND TRUTH COLLECTION

Charles E. Tanner Sep. 1977 32 p refs
(Contract EPA-68-03-2153)
(PB-273513/2; EPA-600/77-100) Avail: NTIS HC A03/MF A01 CSCL 09B

Preparation for the novice data processing analyst and field personnel is described, using tools and basic concepts used in the processing of multispectral scanner data via an interactive or conventional processing system. The guide includes an explanation of the need for the collection of accurate/inexpensive ground truth and brief descriptions of the various ecosystems that will be encountered in this study. Also, a detailed list of

the actual parameters that should be included in a well-designed ground truth form are provided. Sampling schemes from LANDSAT and aircraft multispectral scanner data are also discussed at length along with procedures and recommendations for selecting training samples from photography for use in automatic data processing. GRA

N78-17529* National Aeronautics and Space Administration. Pasadena Office, Calif.

SYSTEM FOR NEAR REAL-TIME CRUSTAL DEFORMATION MONITORING Patent Application

Peter F. MacDoran, inventor (to NASA) (JPL) Filed 21 Dec. 1977 21 p
(Contract NAS7-100)
(NASA-Case-NPO-14124-1; US-Patent-Appl-SN-863024) Avail: NTIS HC A02/MF A01 CSCL 08G

Near real-time crustal deformation monitoring can be achieved by independent stations which receive S-band radio signals from an Apollo Lunar Surface Experiment Package (ALSEP). The received signals are time tagged by a digital code or L-band signals from the Global Positioning System (GPS) using synchronized atomic clocks 18 and 20 at the two stations and then transmitted to a cross-correlation station 22 through telephone lines 14 and 16. The time tags permit the phone line delays to be determined in order for any difference in the phone line delays to be compensated before cross correlating the signals. The fringe frequency observation from ALSEP or delay from GPS are obtained by cross correlation and used to estimate base lines for crustal deformation monitoring. The novelty of the invention resides in the use of an artificial radio signal source of narrow bandwidth for transmission over conventional telephone lines. NASA

N78-17539# Utah Univ., Salt Lake City. Dept. of Meteorology.

CLOUD COMPOSITION DETERMINATION BY SATELLITE SENSING USING THE NIMBUS VI HIGH RESOLUTION INFRARED SOUNDER Interim Report

Robert G. Feddes and Kuo-Nan Liou 15 May 1977 151 p refs
(Contract F19628-75-C-0107)
(AD-A047527; AFGL-TR-77-0123; Scientific-3) Avail: NTIS MF A01 CSCL 04/1

The emphasis in this study is to determine cloud compositions from satellites. The radiative transfer model of spectral infrared radiation in cloudy atmospheres is applied to the most complete set of radiance observations currently available from the Nimbus VI HIRS instrument. The radiative properties of clouds in the HIRS channels are investigated using the discrete-ordinate method for approximating the solution of the radiative transfer equation as it is applied to nonisothermal, inhomogeneous cloudy atmospheres. Analysis of the upwelling radiances from the model indicates that cirrus clouds decrease the upwelling radiance more than middle clouds and that multilayered middle and cirrus clouds are indistinguishable from thick cirrus clouds. Upwelling radiances in cirrus or middle cloud conditions for shortwave CO2 channels are decreased by a greater percentage from their clear column values than are the long-wave CO2 channel radiances. GRA

N78-17622# World Meteorological Organization, Geneva (Switzerland).

MINI METEOROLOGICAL DIRIGIBLE FOR THE SURVEILLANCE AND STUDY OF LOW LAYERS [PROJET DE MINI-DIRIGEABLE METEOROLOGIQUE POUR LA SURVEILLANCE ET L'ETUDE DES BASSES COUCHES]

Claude Besson, Nadine Cenac, Daniel Martin, Jean-Paul Meyer, Christian Rebotier, and Marcel Zephoris In its Instr. and Methods of Observation 1977 p 214-219 In FRENCH

Avail: NTIS HC A12/MF A01

A mini-dirigible for the remote surveillance and investigation of low atmosphere is described. It will give information on aerology, cloud physics, as well as the atmospheric pollution. Two types of measurements are foreseen: (1) in-situ measurements on the

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vertical distribution and physico-chemical evolution of the various minor constituents; and (2) remote measurements to establish air pollution maps. ESA

N78-18480* National Aeronautics and Space Administration, Washington, D. C.

IMPROVED LANDSAT TO GIVE BETTER VIEW OF EARTH RESOURCES

22 Feb. 1978 42 p

(NASA-News-Release-78-22; P78-10026) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The launch data of LANDSAT 3 is announced. The improved capability of the spacecraft's remote sensors (the return beam vidicon and the multispectral scanner) and application of LANDSAT data to the study of energy supplies, food production, and global large-scale environmental monitoring are discussed along with the piggyback amateur radio communication satellite-OSCAR-D, the Plasma Interaction Experiment, and the data collection system onboard LANDSAT 3. An assessment of the utility of LANDSAT multispectral data is given based on the research results to date from studies of LANDSAT 1 and 2 data. Areas studied include agriculture, rangelands, forestry, water resources, environmental and marine resources, cartography, land use, demography, and geological surveys and mineral/petroleum exploration. J.M.S.

N78-18487* Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

SELECTION OF A SEVENTH SPECTRAL BAND FOR THE LANDSAT-D THEMATIC MAPPER Final Report, 15 Aug. 1977 - 15 Jan. 1978

Quentin A. Holmes, Principal Investigator and Daniel R. Nuesch Jan. 1978 96 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP (Contract NAS9-15362)

(E78-10078; NASA-CR-151624; ERIM-300100-4-f) Avail: NTIS HC A05/MF A01 CSCL 08B

The author has identified the following significant results. Each of the candidate bands were examined in terms of the feasibility of gathering high quality imagery from space while taking into account solar illumination, atmospheric attenuation, and the signal/noise ratio achievable within the TM sensor constraints. For the 2.2 micron region and the thermal IR region, inband signal values were calculated from representative spectral reflectance/emittance curves and a linear discriminant analysis was employed to predict classification accuracies. Based upon the substantial improvement (from 78 to 92%) in discriminating zones of hydrothermally altered rocks from unaltered zones, over a broad range of observation conditions, a 2.08-2.35 micron spectral band having a ground resolution of 30 meters was recommended.

N78-18496* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

A SYSTEM ANALYSIS OF THE 13.3 GHz SCATTEROMETER

J. R. Wang Oct. 1977 121 p refs

(Contract NAS9-15200)

(NASA-CR-151627; LEC-11354)

Avail: NTIS

HC A06/MF A01 CSCL 20N

The performance of the 13.3 GHz airborne scatterometer system which is used as a microwave remote sensor to detect moisture content of soil is analyzed with respect to its antenna pattern the signal flow in the receiver data channels, and the errors in the signal outputs. The operational principle and the sensitivity of the system, as well as data handling are also described. The dielectric property of the terrain surface, as far as the scatterometer is concerned, is contained in the assumed forms of the functional dependence of the backscattering coefficient of the incident angle. Author

N78-18662* Wentz (Frank J.) and Associates, Cambridge, Mass.

A TWO-SCALE SCATTERING MODEL WITH APPLICATION TO THE JONSWAP '76 AIRCRAFT MICROWAVE SCATTEROMETER EXPERIMENT Final Report

Frank J. Wentz Dec. 1977 127 p refs

(Contract NAS1-14330)

(NASA-CR-2919) Avail: NTIS HC A07/MF A01 CSCL 08J

The general problem of bistatic scattering from a two scale surface was evaluated. The treatment was entirely two-dimensional and in a vector formulation independent of any particular coordinate system. The two scale scattering model was then applied to backscattering from the sea surface. In particular, the model was used in conjunction with the JONSWAP 1975 aircraft scatterometer measurements to determine the sea surface's two scale roughness distributions, namely the probability density of the large scale surface slope and the capillary wavenumber spectrum. Best fits yield, on the average, a 0.7 dB rms difference between the model computations and the vertical polarization measurements of the normalized radar cross section. Correlations between the distribution parameters and the wind speed were established from linear, least squares regressions. Author

N78-19579* Earth Satellite Corp., Washington, D. C.

APPLICATION OF THE ELECTRICALLY SCANNING MICROWAVE RADIOMETER (ESMR) TO CLASSIFICATION OF THE MOISTURE CONDITION OF THE GROUND Final Report, Apr. 1975 - Mar. 1977

Jack M. Meneely Mar. 1977 43 p refs

(Contract NAS5-22398)

(NASA-CR-156692; ES-1042) Avail: NTIS HC A03/MF A01 CSCL 08M

The ability of the Nimbus 5 ESMR to characterize the moisture condition of the uppermost portion of the soil was evaluated. In the absence of snow cover, ESMR-5 brightness temperatures were compared with computed upper soil zone moisture values from a soil moisture budgeting scheme. The study was conducted over the U.S. Great Plains for the late summer and early fall in 1974 and 1975. Favorable results were limited by the relatively high vegetative cover and infrequent substantial rainfalls at that time of year. Satisfactory characterization of the general moisture condition was deemed feasible in agricultural regions at times of the year when fields were nearly bare. An additional evaluation demonstrated that ESMR-6 data could delineate the active boundary of a snow pack. Author

N78-19591* Naval Research Lab., Washington, D. C. Space Science Div.

MICROWAVE SCANNING RADIOMETRY

James P. Hollinger In AGARD Appl. of Remote Sensing to Ocean Surveillance Sep. 1977 11 p refs

Avail: NTIS HC A13/MF A01

The basic principles of microwave radiometry including a description of antenna properties, a definition of antenna temperature, brightness temperature, and system temperature and a discussion of measurement techniques and accuracies are briefly presented. Then the microwave signals to be expected from calm and rough seas, sea ice, ships and ship wakes, oil slicks, and terrain as well as the attenuation and radiation from the atmosphere are described. Detailed description and the specifications and performance of existing aircraft-borne scanners are given. Selected measurements from these imaging systems are presented to demonstrate their application. Author

N78-19592* British Aircraft Corp. (Operating) Ltd., Bristol (England).

MICROWAVE SCANNING RADIOMETRY (APPLICATIONS)

E. P. L. Windsor and H. McD. Mooney In AGARD Appl. of Remote Sensing to Ocean Surveillance Sep. 1977 25 p

Avail: NTIS HC A13/MF A01

The characteristics of satellite borne passive microwave radiometer described in terms of their potential sensitivity in measurement of physical parameters together with the spatial resolution and global coverage achievable. The application of similar techniques to aircraft borne systems is also discussed. Author

N78-19593# Tetra Tech, Inc., Pasadena, Calif.
INFRARED RADIOMETRY AND VISIBLE SPECTROMETRY
 Henric Hodara and Willard H. Wells /n AGARD Appl. of Remote Sensing to Ocean Surveillance Sep. 1977 47 p

Avail: NTIS HC A13/MF A01

An equation is derived that describes radiometric temperature fluctuations and identifies two major sources of error that mask the true sea temperature changes: humidity fluctuation in the air column between the sea surface and the radiometer, and reflected sky radiance from the rough sea surface. These masking effects are minimized by suitable design of the radiometer. Typical power spectra calculated from radiometric measurements are presented. Author

N78-19594# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
VISIBLE AND INFRARED IMAGING RADIOMETERS FOR OCEAN OBSERVATIONS
 W. L. Barnes /n AGARD Appl. of Remote Sensing to Ocean Surveillance Sep. 1977 20 p refs

Avail: NTIS HC A13/MF A01 CSCL 20F

The technology of visible and infrared imaging sensors designed for the remote monitoring of the oceans is assessed. Emphasis is placed on multichannel scanning radiometers that are either operational or under development. Present design practices and parameter constraints are discussed. Airborne sensor systems examined include the Ocean Color Scanner (OCS) and the Ocean Temperature Scanner (OTS). The Coastal Zone Color Scanner (CZCS) and Advanced Very High Resolution Radiometer (AVHRR), are reviewed with emphasis on design specifications, expected completion, and anticipated performance. Finally, recent technology advances and their probable impact on sensor design are examined. Author

N78-19595# Thomson-CSF, Malakoff (France).
SIDEWAYS-LOOKING RADAR (SLR) USING A SYNTHETIC AERIAL
 J. Genuist /n AGARD Appl. of Remote Sensing to Ocean Surveillance Sep. 1977 22 p In ENGLISH and FRENCH

Avail: NTIS HC A13/MF A01

The sideways-looking radar with synthetic aerial enables a very high resolution image to be obtained of the terrain overflown by an aircraft. The radar range resolution along the direction perpendicular to the path of the aircraft is obtained with a very fine pulse transmission-reception, using pulse compression technique. The longitudinal resolution, along the path of the aircraft is obtained by processing the Doppler signal. Two categories processing were tried: processing by simple filtering and processing by correlation. Different experimental results are presented for each of the processes, analysing the advantages and disadvantages. Author

N78-19710# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PHOTOVOLTAIC REMOTE INSTRUMENT APPLICATIONS: ASSESSMENT OF THE NEAR-TERM MARKET
 (AD-A049115; AD-E000059; NRL-MR-3637) Avail: NTIS HC A02/MF A01 CSCL 04/1

It is shown by use of particle computer simulations that collisionless interactions, due to energetic electron precipitation in the auroral zones, can be responsible for the break from the E-3 dependence of the secondary electron spectrum expected on the basis of collisional models, even at very low altitudes (-180 km). Author (GRA)

N78-20202# British Aircraft Corp. (Operating) Ltd., Bristol (England).
A SURVEY OF EARTH SURFACE OBSERVATION SATELLITES AND THE INTERFACE BETWEEN REMOTE SENSOR AND ATTITUDE CONTROL SYSTEM
 M. J. Hammond /n ESA Attitude and Orbit Control Systems Nov. 1977 p 37-51 refs

Avail: NTIS HC A24/MF A01

A brief survey of earth observation satellites is presented including possible future developments. Consideration is given to the flow of information from remote sensor to user and the areas where satellite attitude measurement and control directly impact on reconstruction of the original scene. An overview of the performance specification and implementation of candidate systems is presented which is concluded by an assessment of a common bus' philosophy related to various system options. Author (ESA)

N78-20203# Hawker Siddeley Dynamics Ltd., Stevenage (England). Space Div.
A PRELIMINARY STUDY OF ATTITUDE MEASUREMENT AND CONTROL REQUIREMENTS FOR EARTH RESOURCES SATELLITES
 M. Burton, J. B. Farrow, and P. J. Elkins /n ESA Attitude and Orbit Control Systems Nov. 1977 p 53-60 refs

Avail: NTIS HC A24/MF A01

Some results relating to attitude measurements and control requirements for Earth Resources Satellites are presented. Major study objectives are to relate, in a quantitative manner, the attitude and orbital motions and measurements of these motions, to the quality of the remote sensor output. To achieve these objectives a FORTRAN computer simulation was developed consisting of models of: (1) remote sensors and output quality criteria; (2) satellite dynamics and kinematics; (3) orbital motion and landmarks; (4) attitude sensors. The simulation contains a number of options for each of the above four models and allows any combination (of remote sensor, satellite, orbit and attitude sensor) to be analyzed. Author (ESA)

N78-20487# Danish Meteorological Inst., Copenhagen.
THE QHM. CONTRIBUTIONS TO THE THEORY AND PRACTICE OF THE QUARTZ HORIZONTAL MAGNETOMETER
 E. KringLauridsen 1977 112 p refs
 (DMI-Geophys-Papers-R-50; ISBN-87-7478-138-3) Avail: NTIS HC A06/MF A01

Use experience with the quartz horizontal magnetometer (QHM) developed in the Thirties at the Danish Meteorological Institute for the measurement of the horizontal component H of the earth's magnetic field is presented. The effects of residual torsion, elastic creep, temperature, humidity, and different measuring speeds and schemes are discussed. Other topics dealt with include dependence of main constants on torsion and time; permanent magnetism in the housing of the QHM; change of dip angle; measurement of b and related sources of error; and assembly, adjustment, and calibration of QHM's. ESA

N78-20732# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
FEASIBILITY OF MONITORING AEROSOL CONCENTRATIONS BY 10.6-MICROMETER BACKSCATTER LIDAR
 Gordon Lerfeld May 1977 19 p refs
 (PB-276389/4; NOAA-TR-ERL-387-WPL-50; NOAA-77112810) Avail: NTIS HC A02/MF A01 CSCL 04B

A prototype lidar system was built and was operated in conjunction with equipment that permitted direct measurement of particle size distribution of aerosols in essentially the same sampled volume. The backscattered signals measured by the test system agreed to within a factor of two with the backscatter computed from the measured particle size distributions. The experimental results were used to predict the performance of systems having transmitter powers and receiver collecting optics different from those used for the test system. GRA

N78-21191# National Aeronautics and Space Administration, Washington, D. C.
HEAT CAPACITY MAPPING MISSION (HCMM) LAUNCH
 19 Apr. 1978 30 p
 (NASA-TM-79429; E-651-78-01) Avail: NTIS HC A03/MF A01 CSCL 22A

The heat capacity mapping mission (HCMM) supports exploratory scientific investigations using infrared remote sensor derived temperature measurements of the earth's surface within

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a 12-hour interval at times when the temperature variation is at a maximum to establish the feasibility of applying the day/night temperature difference measurements to the determination of thermal inertia. The HCMM spacecraft orbit was chosen to be synchronous with a nominal ascending equatorial crossing time of 2:00 p.m., in order to provide north middle latitude (40 degrees) crossing times of 1:30 p.m. and 2:30 a.m. at 12-hour intervals approximately every 5 days. Data will be acquired by a two channel scanning radiometer. One spectral channel covers the visible and near infrared band between 0.5 and 1.1 micrometers; the other channel covers the thermal infrared band between 10.5 and 12.5 micrometers. From the nominal orbit altitude of 620 km, the spatial resolution of the visible and thermal infrared radiometer channels will be approximately 500 by 500 meters at nadir, and the ground swath of data coverage along the track will be 700 km wide. Author

N78-21511*# General Electric Co., Philadelphia, Pa. Space Div.

LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT Technical Report, 23 Jul. - 23 Oct. 1977

2 Nov. 1977 224 p refs ERTS

(Contract NAS5-21808)

(E78-10105; NASA-CR-156720; DOC-77sds4258) Avail: NTIS HC A10/MF A01 CSCL 22A

N78-21512*# General Electric Co., Philadelphia, Pa. Space Div.

LANDSAT-C FLIGHT ACTIVATION PLAN

10 Oct. 1977 178 p ERTS

(Contract NAS5-21808)

(E78-10106; NASA-CR-156718; DOC-77SDS4222) Avail: NTIS HC A09/MF A01 CSCL 22A

N78-21540*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

LANDSAT SENSORS

Stanley C. Freden and Robert D. Price *In its Appl. of Remote Sensing to the Chesapeake Bay Reg.* Feb. 1978 p 123-140 refs

Avail: NTIS HC A17/MF A01 CSCL 14B

LANDSAT 1, launched in July 1972, and LANDSAT 2, launched in January 1975, are equipped with a similar complement of sensors. Each spacecraft has both a return beam vidicon camera system and a multispectral scanner for acquiring high resolution multispectral data of the Earth's surface on a global basis. A description is given of these imaging systems and the primary sensors on the LANDSAT 1 and 2 spacecraft. Author

N78-21549*# Maryland Univ., College Park.

LIDAR: A LASER TECHNIQUE FOR REMOTE SENSING

Thomas D. Wilkerson and G. Daniel Hickman (Appl. Sci. Tech., Inc., Germantown, Md.) *In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg.* Feb. 1978 p 249-265 refs

Avail: NTIS HC A17/MF A01 CSCL 20E

Experimental airborne lidar systems proved to be useful for shallow water bathymetric measurements, and detection and identification of oil slicks and algae. Dye fluorescence applications using organic dyes was studied. The possibility of remotely inducing dye fluorescence by means of pulsed lasers opens up several hydrospheric applications for measuring water currents, water temperature, and salinity. Aerosol measurements by lidar are also discussed. J.A.M.

N78-21553*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

CONTRIBUTION OF REMOTE SENSING TO UNDERSTAND THE BAY AS A SYSTEM

Archibald B. Park, Daniel Anderson, Charles G. Bohn, Wayne T. Chen, and Robert W. Johnson *In its Appl. of Remote Sensing to the Chesapeake Bay Reg.* Feb. 1978 p 289-296

Avail: NTIS HC A17/MF A01 CSCL 08J

The natural resource management information system concept designed specifically for use with remote sensing is discussed in terms of understanding and studying the Chesapeake Bay as a total system. The Bay is defined as a system comprising the lithosphere, the hydrosphere, and the biosphere, that is the vertical profile encompassed by the systems and a two dimensional plane defining the total watershed of the Bay from the headwaters of its tributaries to a distance in the ocean defined by ten tidal cycles. The Chesapeake Bay system is assumed to be the ecosystem in the largest sense. Ecological partitioning, a methodology resulting from studies of land systems for partitioning the land into geobotanical landscape units, is included along with a breakdown of LANDSAT investigations according to subject area. J.M.S.

N78-21571*# National Aeronautics and Space Administration, Washington, D. C.

METRIC REMOTE SENSING EXPERIMENTS IN PREPARATION FOR SPACELAB FLIGHTS

G. Galibert 1978 29 p Transl. into ENGLISH from *Experiences de teledetection metrique dans les alpes en vue des vols spacelab*, Revue de geographie Alpine, France, vol. 66, no. 1, 1978, p 43-63

(NASA-TM-75093) Avail: NTIS HC A03/MF A01 CSCL 14E

Aerial and ground photographs of Wallis mountains and of Dolomiti di Cortina d'Ampezzo in Italy were made using spectrozonal emulsions and optical multichannel filters. A metric camera was used in the perspective of the first Spacelab flight aboard the space shuttle. Elementary forms of alpine geomorphology and ice or snow phenomena are detectable on these metric scenes. Author

N78-21572*# Aerojet Electrosystems Co., Azusa, Calif.

SNOW PARAMETERS FROM NIMBUS-6 ELECTRICALLY SCANNED MICROWAVE RADIOMETER Final Report

G. Abrams and A. T. Edgerton Sep. 1977 195 p refs

(Contract NAS5-23751)

(NASA-CR-156725; Rept-1932FR-1) Avail: NTIS HC A09/MF A01 CSCL 08L

Two sites in Canada were selected for detailed analysis of the ESMR-6/snow relationships. Data were analyzed for February 1976 for site 1 and January, February and March 1976 for site 2. Snowpack water equivalents were less than 4.5 inches for site 1 and, depending on the month, were between 2.9 and 14.5 inches for site 2. A statistically significant relationship was found between ESMR-6 measurements and snowpack water equivalents for the Site 2 February and March data. Associated analysis findings presented are the effects of random measurement errors, snow site physiography, and weather conditions on the ESMR-6/snow relationship.

N78-21574*# Lockheed Electronics Co., Houston, Tex.

A MODEL OF THE 0.4-GHz SCATTEROMETER

S. T. Wu Jan. 1978 131 p refs

(Contract NAS9-15200)

(NASA-CR-151693; LEC-11087) Avail: NTIS HC A07/MF A01 CSCL 20F

The 0.4 GHz aircraft scatterometer system used for the agricultural soil moisture estimation program is analyzed for the antenna pattern, the signal flow in the receiver data channels, and the errors in the signal outputs. The operational principal, system sensitivity, data handling, and resolution cell length requirements are also described. The backscattering characteristics of the agriculture scenes are contained in the form of the functional dependence of the backscattering coefficient on the incidence angle. The substantial gains of the cross-polarization term of the horizontal and vertical antennas have profound effects on the cross-polarized backscattered signals. If these signals are not corrected properly, large errors could result in the estimate of the cross-polarized backscattering coefficient. It is also necessary to correct the variations of the aircraft parameters during data processing to minimize the error in the 0 degree estimation. Recommendations are made to improve the overall performance of the scatterometer system. Author

N78-21720*# Hughes Aircraft Co., Los Angeles, Calif. Space and Communications Group.

**SEVERE STORMS OBSERVING SATELLITE (STORMSAT)
Final Report**

Aug. 1976 196 p refs

(Contract NAS5-20812)

(NASA-CR-156735; SCG-60320R) Avail: NTIS
HC A09/MF A01 CSCL 04B

The primary payload for this satellite is the Advanced Atmospheric Sounding and Imaging Radiometer which will perform precise infrared temperature sounding and visible/infrared imaging from geostationary orbit. A secondary payload instrument which may be utilized on STORMSAT is the Microwave Atmospheric Sounding Radiometer which provides an independent set of temperature and humidity sounding in cloudy, meteorologically active regions. The study provides satellite designs and identifies mission-unique subsystems using the Multimission Modular Spacecraft using a Shuttle/Interim Upper Stage launch vehicle.

Author

N78-21737*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

**REMOTE SENSING OF GULF STREAM USING GEOS-3
RADAR ALTIMETER**

Clifford D. Leita, Norden E. Huang (EG and G Washington Anal. Serv. Center, Inc., Pocomoke City, Md.), and Carlos G. Parra Apr. 1978 34 p refs

(NASA-TP-1209) Avail: NTIS HC A03/MF A01 CSCL 08J

Radar altimeter measurements from the GEOS-3 satellite to the ocean surface indicated the presence of expected geostrophic height differences across the the Gulf Stream. Dynamic sea surface heights were found by both editing and filtering the raw sea surface heights and then referencing these processed data to a 5 minute x 5 minute geoid. Any trend between the processed data and the geoid was removed by subtracting out a linear fit to the residuals in the open ocean. The mean current velocity of 107 ± 29 cm/sec calculated from the dynamic heights for all orbits corresponded with velocities obtained from hydrographic methods. Also, dynamic topographic maps were produced for August, September, and October 1975. Results pointed out limitations in the accuracy of the geoid, height anomaly deteriorations due to filtering, and lack of dense time and space distribution of measurements.

Author

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Includes economic analysis.

A78-24415 # Considerations concerning the payload of a European remote-sensing satellite (Überlegungen zur Nutzlast eines Europäischen Erdkundungssatelliten). E. Achtermann, J. Hoffman, and E. Velten (Dornier-System GmbH, Friedrichshafen, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Jahrestagung, 10th, Berlin, West Germany, Sept. 13-15, 1977, Paper 77-023*. 24 p. In German.

A future European remote-sensing satellite is evaluated from a user's point of view. Data costs and applications are discussed in terms of Earth-resources measurement, weather prediction, and disaster assistance. Structural and design parameters are given, including: three-axis stabilization, antenna configuration, power source (solar), optical resolution, spectral bandwidth, data transmission and reception, and Earth-tracking. Singled out for special attention is the synthetic aperture radar (SAR), used to augment remote-sensing capability. D.M.W.

A78-25654 A development assistance program in remote sensing. M. Conitz (U.S. Department of State, Agency for International Development, Washington, D.C.). (*American Association for the Advancement of Science, Annual Meeting, Denver, Colo., Feb. 25, 1977.*) *Photogrammetric Engineering and Remote Sensing*, vol. 44, Feb. 1978, p. 177-182. 8 refs.

The paper reviews the work of the Agency for International Development (AID) in terms of developing remote sensing technology and its application to developing countries. The projects which AID has sponsored are described and include regional workshops for training in remote sensing technology, the awarding of grants to developing countries, research in remote sensing of resources, applications of Landsat imagery in demographic studies, and research in land-development projects. Information yielded from these and other projects has enabled AID to construct profiles of developing countries in terms of needs and resources. Cooperation between AID and NASA for the world-wide demonstration of space technology (AIDSAT for Space Age Technology) is discussed along with the creation of regional centers in various countries for focusing these projects. S.C.S.

A78-25801 Union Radio Scientifique Internationale, Open Symposium, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Proceedings (Union Radio Scientifique Internationale, Colloque Ouvert, La Baule, Loire-Atlantique, France, April 28-May 6, 1977, Comptes Rendus). Symposium sponsored by the Centre National d'Etudes Spatiales, Centre National d'Etudes des Télécommunications, and Secrétariat d'Etat aux Universités. Issy-les-Moulineaux, Hauts-de-Seine, France, Comité National Français de la Radio-électricité Scientifique, 1977. 657 p. In French and English. \$30.40.

Attention is devoted to clear air and earth surface properties influencing radio wave and optical propagation, the fine structure of rain and the prediction of rain attenuation effects, earth-satellite radio propagation studies, transmission channel properties, active and passive atmospheric remote sensing, and remote sensing of the surface of the earth. Topics of the papers include the effect of tropospheric ducts on radio propagation, diffraction scattering from mountain ridges, the fine structure of microwave cross-polarization during rain, ATS-6 radio wave propagation experiments, the effects of atmospheric turbulence on synthetic aperture radar, multipath propagation over irregular terrain at UHF, and hydrological applications of radar. J.M.B.

A78-26192 * # Future use of digital remote sensing data. G. W. Spann and N. L. Jones (Metrics, Inc., Atlanta, Ga.). In: *Data Management Symposium, Huntsville, Ala., October 18, 19, 1977, Proceedings*. Huntsville, Ala., University of Alabama, 1978, p. 235-242. Contract No. NAS8-32397.

Users of remote sensing data are increasingly turning to digital processing techniques for the extraction of land resource, environmental, and natural resource information. This paper presents the results of recent and ongoing research efforts sponsored, in part, by NASA/Marshall Space Flight Center on the current uses of and future needs for digital remote sensing data. An ongoing investigation involves a comprehensive survey of capabilities for digital Landsat data use in the Southeastern U.S. Another effort consists of an evaluation of future needs for digital remote sensing data by federal, state, and local governments and the private sector. These needs are projected into the 1980-1985 time frame. Furthermore, the accelerating use of digital remote sensing data is not limited to the U.S. or even to the developed countries of the world. (Author)

A78-26194 * # Low cost data distribution. C. E. Catoe (NASA, Washington, D.C.). In: *Data Management Symposium, Huntsville, Ala., October 18, 19, 1977, Proceedings*. Huntsville, Ala., University of Alabama, 1978, p. 259-269. 16 refs.

The paper examines some of the technology developments which are needed to bridge the gap between research and development and the operational data distribution needs of the user community. In the short term (1978-1985), the data distribution technology activities will be concerned with the distribution needs of the user spacecraft, the central ground facility, the regional data center, and the user terminals. In the long term (1985-2000), the data distribution activities will place emphasis on those technology areas which are required for the user community to interact directly with a spacecraft to obtain processed data. User applications by government and private organizations are discussed, as are future low-cost distribution scenarios. M.L.

A78-26399 * Regimes for the ocean, outer space, and weather. S. Brown, N. W. Cornell, L. L. Fabian, and E. B. Weiss. Research supported by NSF, NASA, Ford Foundation, and Rockefeller Foundation. Washington, D.C., Brookings Institution, 1977. 265 p. 203 refs. \$4.50.

The allocation of resources among users of the oceans, outer space and the weather is discussed. Attention is given to the international management of maritime navigation, the control of fisheries, offshore oil and gas exploitation, mineral exploitation in the deep seabed (especially the mining of manganese nodules), and the regulation of oceanographic studies. The management of outer space is considered, with special reference to remote sensing by satellites, television broadcasting, the technical requirements of maritime satellites, and problems associated with satellite frequency and orbit allocation. Rainmaking and typhoon modification, as well as the distribution of weather modification capabilities in the world, are also mentioned. The United Nations, international agencies and tribunals, and multi- or bilateral agreements are some of the implements suggested for use in the regulation of the oceans, outer space and the weather. J.M.B.

A78-27823 Remote sensing of earth resources. Volume 5 - Annual Remote Sensing of Earth Resources Conference, 5th, Tullahoma, Tenn., March 29-31, 1976, Technical Papers. Edited by F. Shahrokhi (Tennessee, University, Tullahoma, Tenn.). Tullahoma, University of Tennessee, 1977. 647 p. \$30.

Some topics related to the application of satellite data for land use studies include land use mapping for the Texas land information system, the application of remote sensing technology for effective barrier island management, and urban use inventories with high altitude photography. Some technical problems considered include the production of diazo color composite images with inexpensive equipment, the automatic analysis of data from the Skylab S-192 multispectral scanner for agricultural applications, and automated techniques to estimate litter moisture by objective analysis of

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SMS/GOES satellite data. Reports on studied substances or situations include the remote detection of chlorophyll-A in coastal waters, geological reconnaissance of an oil shale region by remote sensing techniques, and the remote sensing of forest fire smoke from space. Equipment studies are also presented, as are several other investigations on a variety of subjects. M.L.

A78-28376 Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volumes 1 & 2 (Journées de Télédétection, Toulouse, France, October 26-28, 1976, Proceedings. Volumes 1 & 2). Workshop sponsored by the Groupement pour le Développement de la Télédétection Aérospatiale. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977. Vol. 1, 371 p.; vol. 2, 340 p. In French. Price of two volumes, \$30.

The results of remote sensing programs conducted in France during the period 1972 to 1975 are reported. Subjects of the papers include the image quality obtained with the multispectral scanner Daedalus, environmental influences on vegetation as read in spectral signatures, remote sensing of cochineal assaults on pine forests, soil salinity analyses from aerial reconnaissance data, the detection of a thermal plume arising in the sea adjacent to an electric power plant, remote thermal sensing of quartz veins, oil spill detection by aerial reconnaissance, geological mapping applications of balloon-borne detection systems, the bathymetry of Mediterranean regions through multispectral scanning, and ricefield monitoring with aerial reconnaissance and Landsat data. J.M.B.

A78-28377 Remote sensing operations put into effect (Les opérations de télédétection réalisées). L. Laidet and E. Marche (Groupement pour le Développement de la Télédétection Aérospatiale, Toulouse, France). In: Workshop on Remote Sensing, Toulouse, France, October 26-28, 1976, Proceedings. Volume 1. Toulouse, Groupement pour le Développement de la Télédétection Aérospatiale, 1977, p. 1-10. In French.

Remote sensing campaigns involving aircraft reconnaissance and stratospheric balloon observations of France since 1971 are described. The programs have made use of various radiometers (including one of the push-broom type), as well as high-resolution photography. Purposes of the aerial surveys range from geological and hydrological assessments to studies of farm crops, forests, oyster cultures and pollution. The data processing techniques adopted for

A78-29664 # Remote sensing by satellite in the light of international law (Teledetekcja satelitarna w swietle prawa miedzynarodowego). K. Wiewirowska (Polski Instytut Spraw Miedzynarodowych, Warsaw, Poland). *Postepy Astronautyki*, vol. 10, no. 4, 1977, p. 103-121. 25 refs. In Polish.

The paper investigates the legal problem of remote sensing by satellite from the viewpoint of states' sovereign rights to natural resources and raw materials. Three main viewpoints are distinguished, around which all discussion revolves: (1) unrestricted remote sensing, (2) rigorous restrictions, and (3) a compromise position taking into account both the national interests of states and the need for broadly conceived international cooperation. P.T.H.

A78-29828 Proposed parameters for an operational Landsat. A. P. Colvocoresses (U.S. Geological Survey, National Center, Reston, Va.). In: Mapping with remote sensing data; Proceedings of the Second Annual William T. Pecora Memorial Symposium, Sioux Falls, S. Dak., October 25-29, 1976.

Falls Church, Va., American Society of Photogrammetry, 1977, p. 15-24. 15 refs.

The paper suggests parameters for an operational Landsat for the following items: sensor type, wavebands, spatial frequency (resolution) or picture element (pixel) in terms of ground coverage, quantizing level (radiometric sensitivity), sampling frequency, data rate, sensor weight (est.), sensor power req. (est.), expected sensor life, satellite orbit, ground coverage, orbital position and attitude stability and determination, and data storage capability. Criteria for

the proposed Landsat are continuity with respect to Landsat-1, -2, and -C; full availability of data on a global basis; and economic practicality. While Landsat has limitations because its resolution is at present based on a 79-m pixel and the system does not resolve the third (relief) dimension, Landsat would greatly facilitate planimetric mapping since the system approaches orthogonality to the point where relief displacement need be considered in only the more rugged areas of the earth. M.L.

A78-30198 # International collaboration in space: Legal questions (Mezhdunarodnoe sotrudnichestvo v kosmose: Pravovye voprosy). V. S. Vereshchetin. Moscow, Izdatel'stvo Nauka, 1977. 264 p. 250 refs. In Russian.

International law to the extent it relates to space programs is reviewed. Emphasis is placed on international agreements on space and attention is given to such specific programs as Intercosmos, the USSR space program in the aspect of collaboration with other nations, the joint European program, international programs involving NASA, and the role of the United Nations in space law. Consideration is then given to the peaceful uses of space, and to government sovereignty in space law. Space law is discussed in reference to communication satellites, satellite television broadcasting, navigation satellites, meteorological satellites, remote sensing of earth resources, and orbital stations. B.J.

N78-16754# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 27

17 Jan. 1978 79 p refs Transl. into ENGLISH from Russian articles

(JPRS-70493) Avail: NTIS HC A05/MF A01

Advances in Soviet technology discussed include: computer networks and networking; monitoring holographic storage devices; weather service satellites; geodesy; and interpreting ocean data obtained from space. A.R.H.

N78-17452*# National Conference of State Legislatures, Denver, Colo.

STATE RECOMMENDATIONS ON APPROACHES TO LANDSAT Final Report

Sally M. Bay and Peggy Wubker 13 Apr. 1977 34 p refs (Contract NASw-2995)

Avail: NTIS HC A03/MF A01 CSCL 05B

The feasibility of continuing the LANDSAT program is contingent upon the success of the technology transfer process to state and local governments. The focus of these concerns can be generally expressed in terms of these issue areas: (1) user needs, in terms of awareness, technical capabilities, and training; (2) product availability and pricing; and (3) roles and communication links, in terms of federal and state governments, the private sector, and the universities. The perspective of the states on these issues are classified. Where possible, alternative strategies for accomplishing the satellite technology transfer for effective state implementation are suggested. Those suggestions

are based on the recommendations offered by the state and local user community. Author

N78-18098*# Teledyne Brown Engineering, Huntsville, Ala.
SURVEY: NATIONAL ENVIRONMENTAL SATELLITE SERVICE

Nov. 1977 35 p
 (Contract NAS8-32539)
 (NASA-CR-150546; SD77-MSFC-2152) Avail: NTIS
 HC A03/MF A01 CSCL 22A

The national Environmental Satellite Service (NESS) receives data at periodic intervals from satellites of the Synchronous Meteorological Satellite/Geostationary Operational Environmental Satellite series and from the Improved TIROS (Television Infrared Observational Satellite) Operational Satellite. Within the conterminous United States, direct readout and processed products are distributed to users over facsimile networks from a central processing and data distribution facility. In addition, the NESS Satellite Field Stations analyze, interpret, and distribute processed geostationary satellite products to regional weather service activities. Author

N78-18485*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

COST BENEFIT ANALYSIS OF THE TRANSFER OF NASA REMOTE SENSING TECHNOLOGY TO THE STATE OF GEORGIA Final Report

R. P. Zimmer, Principal Investigator, R. D. Wilkins, D. L. Kelly, and D. M. Brown Nov. 1977 144 p refs EREP
 (Contract NAS9-15283)

(E78-10076; NASA-CR-151615) Avail: NTIS
 HC A07/MF A01 CSCL 05B

The author has identified the following significant results. First order benefits can generally be quantified, thus allowing quantitative comparisons of candidate land cover data systems. A meaningful dollar evaluation of LANDSAT can be made by a cost comparison with equally effective data systems. Users of LANDSAT data can be usefully categorized as performing three general functions: planning, permitting, and enforcing. The value of LANDSAT data to the State of Georgia is most sensitive to the parameters: discount rate, digitization cost, and photo acquisition cost. Under a constrained budget, LANDSAT could provide digitized land cover information roughly seven times more frequently than could otherwise be obtained. Thus on one hand, while the services derived from LANDSAT data in comparison to the baseline system has a positive net present value, on the other hand if the budget were constrained, more frequent information could be provided using the LANDSAT system than could otherwise be obtained.

N78-18490*# National Aeronautics and Space Administration, Washington, D. C.

ON THE DEVELOPMENT OF EARTH OBSERVATION SATELLITE SYSTEMS

Nov. 1977 38 p Transl. into ENGLISH of "Chikyu kansoku eisei shisutemu no kaiatsu ni tsuite" Sci. and Technol. Agency of Japan, Tokyo, 12 Jul. 1977 p 1-81 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Science and Technology Agency of Japan, Tokyo
 (Contract NASw-2790)

(NASA-TM-75064) Avail: NTIS HC A03/MF A01 CSCL 22A

Subsequent to the launching of the first LANDSAT by NASA, Japan has recognized the importance of data from earth observation satellites, has conducted studies, and is preparing to develop an independent system. The first ocean observation satellite will be launched in 1983, the second in 1985. The first land observation satellite is scheduled to be launched in 1987 and by 1990 Japan intends to have both land and ocean observation systems in regular operation. The association reception and data processing systems are being developed. Author

N78-18491*# National Aeronautics and Space Administration, Washington, D. C.

OUTLINE OF THE SURVEY ON THE DEVELOPMENT OF EARTH OBSERVATION SATELLITES

Dec. 1977 84 p Transl. into ENGLISH from Japanese report, Jul. 1977 p 1-98 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Science and Technology Agency, Tokyo

(Contract NASw-2790)

(NASA-TM-75065) Avail: NTIS HC A05/MF A01 CSCL 22A

An independent earth observation system with land and sea satellites to be developed by Japan is described. Visible and infrared radiometers, microwave radiometers, microwave scatterometers, synthetic aperture radar, and laser sensors are among the instrumentation discussed. Triaxial attitude control, basic technology common to sea and land observation satellites as well as land data analytical technology developed for U.S. LANDSAT data are reviewed. Author

N78-18492*# National Aeronautics and Space Administration, Washington, D. C.

PRINCIPLE CHARACTERISTICS OF THE NATIONAL EARTH OBSERVATION SATELLITE. PROJECT SPOT

M. Cazenave 31 Oct. 1977 36 p ref Transl. into ENGLISH of "Caracteristiques Principales du Satellite National d'Observation de la Terre. Project SPOT". Doc. CST/D863 CNES, Paris, 31 Oct. 1977 p 1-30 Transl. by Transemanatics, Inc., Wash., D. C.

(Contract NASw-2792)

(NASA-TM-75081) Avail: NTIS HC A03/MF A01 CSCL 22A

A recent meeting of the Economic and Social Committee examined the programs and means currently being implemented by France in the field of space research and industry which could bring about fast results. This was prompted by man's desire to insure rational resource management of his planet and by man's awareness of the definite contribution that space observation can make to this field of research. Through discussion, the Economic and Social Committee has approved the plan for creating an earth observation satellite. A detailed discussion of the principle characteristics of this earth observation satellite include the objectives, the orbit, characteristics and operations of the platform, maintenance, attitude measurement, the power available and many other characteristics. Author

N78-18499*# General Electric Co., Philadelphia, Pa. Space Div.

POST LANDSAT D ADVANCED CONCEPT EVALUATION (PLACE)

1 Dec. 1977 67 p Sponsored by NASA
 (NASA-CR-155769) Avail: NTIS HC A04/MF A01 CSCL 22A

An outline is given of the mission objectives and requirements, system elements, system concepts, technology requirements and forecasting, and priority analysis for LANDSAT D. User requirements and mission analysis and technological forecasting are emphasized. Mission areas considered include agriculture, range management, forestry, geology, land use, water resources, environmental quality, and disaster assessment. J.M.S.

N78-18505# Swedish Space Corp., Solna.
QUICK-LOOK CAPABILITY IN A EUROPEAN EARTH RESOURCES SATELLITE DATA NETWORK. VOLUME 2: APPENDICES 5 TO 7 Final Report

Paris ESA 15 Apr. 1977 148 p 2 Vol.

(Contract ESA-SC/128-HQ)

(FU15-4-vol-2-App-5-7; ESA-CR(P)-977-Vol-2-App-5-7) Avail: NTIS HC A07/MF A01

Additional information is provided related to the assessment of an optimum quick-look system to meet user requirements in an earth resources satellite data network (Earthnet) to be developed by the European Space Agency. ESA

N78-18566*# Servicio Geologico de Bolivia, La Paz.
BOLIVIAN SATELLITE TECHNOLOGY PROGRAM ON ERTS NATURAL RESOURCES [PROGRAMA DEL SATELITE TECNOLÓGICO DE RECURSOS NATURALES ERTS: BOLIVIA SERVICIO GEOLOGICO DE BOLIVIA]

Carlos Brockmann H., Principal Investigator, Luis Bartolucci C., Robert Hoffer, D. W. Levandowski, Isaac Ugarte, Rene Valenzuela

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R., Moises Urena E., and Reynaldo Oros Jul. 1977 168 p refs In ENGLISH and SPANISH Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (E78-10087; NASA-CR-155765; Rept-1) Avail: NTIS HC A08/MF A01 CSCL 08G

The author has identified the following significant results. Application of digital classification for mapping land use permitted the separation of units at more specific levels in less time. A correct classification of data in the computer has a positive effect on the accuracy of the final products. Land use unit comparison with types of soils as represented by the colors of the coded map showed a class relation. Soil types in relation to land cover and land use demonstrated that vegetation was a positive factor in soils classification. Groupings of image resolution elements (pixels) permit studies of land use at different levels, thereby forming parameters for the classification of soils.

N78-19573* Atomic Energy Commission, Dacca (Bangladesh). **BANGLADESH ERTS (LANDSAT) PROGRAMME: A REVIEW OF THE PROGRAMME AND A REPORT ON THE ACTIVITIES Final Report, Aug. 1972 - Nov. 1977**

Anwar Hossain, Principal Investigator Nov. 1977 57 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (E78-10095; NASA-CR-155777) Avail: NTIS HC A04/MF A01 CSCL 05B

N78-19584* Army Engineer Topographic Labs., Fort Belvoir, Va.

A SELECTED BIBLIOGRAPHY OF CORPS OF ENGINEERS REMOTE SENSING REPORTS

Theodore C. Vogel and E. James Books Aug. 1977 228 p refs (AD-A049351; ETL-0126) Avail: NTIS HC A11/MF A01 CSCL 15/4

The purpose of this bibliography is to present a selected list of remote sensing technology reports and papers published by the U.S. Army Corps of Engineer Divisions, Districts, and Research Laboratories. This bibliography documents the importance of remote sensing technology to the Corps of Engineers and the many and varied tasks to which it has been applied.

Author (GRA)

N78-20567* Nebraska Univ., Lincoln.

APPLICATIONS OF REMOTE SENSING IN RESOURCE MANAGEMENT IN NEBRASKA Annual Report, 1 May 1976 - 30 Apr. 1977

Marvin P. Carlson, Principal Investigator 30 Apr. 1977 92 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Grant NGL-28-004-020)

(E78-10099; NASA-CR-155801)

Avail: NTIS HC A05/MF A01 CSCL 05A

N78-20568* South Dakota State Univ., Brookings. Remote Sensing Inst.

INVESTIGATION OF REMOTE SENSING TECHNIQUES AS INPUTS TO OPERATIONAL RESOURCE MANAGEMENT Final Report, 10 Mar. 1975 - 11 Jun. 1977

Fred A. Schmer, Principal Investigator, Robert E. Isakson, and Jeff C. Eidenshink Jun. 1977 172 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS (Contract NAS5-20982)

(E78-10100; NASA-CR-155962; SDSU-RSI-77-12; Rept-7)

Avail: NTIS HC A08/MF A01 CSCL 05A

The author has identified the following significant results. Visual interpretation of 1:125,000 color LANDSAT prints produced timely level 1 maps of accuracies in excess of 80% for agricultural land identification. Accurate classification of agricultural land via digital analysis of LANDSAT CCT's required precise timing of the date of data collection with mid to late June optimum for western South Dakota. The LANDSAT repetitive nine day cycle over the state allowed the surface areas of stockdams and small reservoir systems to be monitored to provide a timely approximation of surface water conditions on the range. Combined use of DIRS, K-class, and LANDSAT CCT's demonstrated the ability to produce aspen maps of greater detail and timeliness than was available using US Forest Service maps. Visual temporal analyses of LANDSAT imagery improved highway map drainage information and were used to prepare a seven county drainage network. An optimum map of flood-prone areas was developed, utilizing high altitude aerial photography and USGS maps.

N78-21527* United States Senate, Washington, D. C.

THE CHESAPEAKE BAY: OUR REGIONAL RESOURCE

Charles McC. Mathias, Jr. In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 5-10

Avail: NTIS HC A17/MF A01 CSCL 08J

The contents are presented of a speech given by the Hon. Charles McC. Mathias, Jr. on the value of the Chesapeake Bay as a resource and the need to protect its environmental quality. L.S.

N78-21536* Maryland Univ., College Park.

MISSION OF A REMOTE SENSING CENTER

Robert M. Ragan, Dixie A. Pemberton, and Thomas D. Wilkerson In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 55-57

Avail: NTIS HC A17/MF A01 CSCL 05B

The establishment of a center for remote sensing was proposed to provide the following: (1) service, research, and education in the developing discipline of remote sensing; (2) effect multidisciplinary linkages between scientists and users of remote sensing and those who develop remote sensing techniques; and (3) strengthen and extend existing remote sensing capabilities into a cohesive program. Author

N78-21537* Maryland Univ., Cambridge. Center for Environmental and Estuarine Studies.

ON MEASURING THE STATE OF THE BAY

Peter E. Wagner In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 87-101 refs

Avail: NTIS HC A17/MF A01 CSCL 08J

The requirements necessary to establish a comprehensive data base for the Chesapeake Bay are discussed. Three essential questions were addressed: (1) which entities should be measured; (2) how close together should measurements be made in space and time; and (3) what should be done with the data. Possible answers to the questions were evaluated in relation to existing technology, cost effectiveness, and potential uses of the data base. P.R.A.

N78-21543* Maryland Univ., Prince Frederick. Chesapeake Biological Lab.

REGIONAL ENERGETIC COUPLING OF MAN AND HIS ENVIRONMENT: DATA REQUIREMENTS

J. A. Mihursky, W. R. Boynton, W. M. Kemp, M. L. Homer, and G. E. Unger (Michigan Univ., Ann Arbor) In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 157-175 refs

Avail: NTIS HC A17/MF A01 CSCL 13B

An energy analysis methodology was developed to serve as a rational basis for evaluating alternative regional management/use schemes. Human and natural systems are coupled and can be interpreted, using a common base of energy-flow analysis to evaluate past, present, and future states of regional integrated

systems in the coastal zone and to provide the capability for rational selection of alternative patterns of resource use. Energy flows (or flows of dollars or materials converted to energy equivalents) are believed to be the basic factor in the organizations of all types of systems. An analysis example is provided of an estuarine subsystem of the Chesapeake Bay, and tabular listings of regional data needs are given. Current remote sensing capabilities were used to provide some of the necessary information. Author

N78-21547*# Power Plant Siting Program, Annapolis, Md.
THERMAL DISCHARGES AND THEIR ROLE IN PENDING POWER PLANT REGULATORY DECISIONS

Myron H. Miller /In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 223-237 refs

Avail: NTIS HC A17/MF A01 CSCL 13B

Federal and state laws require the imminent retrofit of offshore condenser cooling to the newer steam electric stations. Waiver can be granted based on sound experimental data, demonstrating that existing once-through cooling will not adversely affect aquatic ecosystems. Conventional methods for monitoring thermal plumes, and some remote sensing alternatives, are reviewed, using on going work at one Maryland power plant for illustration. Author

N78-21555*# National Aeronautics and Space Administration.
 Goddard Space Flight Center, Greenbelt, Md.

USE OF REMOTE SENSING IN FACILITY SITING

Milton L. Moon, Robert F. Hunt, John McFall, Jr., John A. Pijanowski, and Robert D. Price /In its Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 303-309 ref

Avail: NTIS HC A17/MF A01 CSCL 13B

Environmental parameters important to, and necessary for, an environment impact assessment in terms of site selection for an electric power plant are defined. Remote sensing techniques and/or instrumentation applicable to site evaluation are described. Problem areas are discussed and recommendations given. J.M.S.

N78-21559*# National Conference of State Legislatures, Denver, Colo.

NCSL TASK FORCE FINDINGS ON FEASIBLE STATE USES OF LANDSAT

Sally M. Bay /In NASA. Goddard Space Flight Center Appl. of Remote Sensing to the Chesapeake Bay Reg. Feb. 1978 p 333-344 refs

Avail: NTIS HC A17/MF A01 CSCL 05A

Data needs for state natural resources programs, state capabilities for using satellite technology, and the existing remote sensing technology are reviewed. State programs in land use planning, wetlands management, coastal zone management, transportation planning, and forestry management are summarized. Emphasis is placed on the use of LANDSAT imagery. J.M.S.

N78-21573*# ECON, Inc., Princeton, N. J.

THE FIRST SEASAT-A INDUSTRIAL USERS WORKSHOP

Kenneth W. Hicks 10 Feb. 1978 322 p refs Workshop held at Princeton, N. J., 29-30 Nov. 1977

(Contract NASw-3047)

(NASA-CR-156149) Avail: NTIS HC A14/MF A01 CSCL 05B

The purpose of this workshop was to begin the process of definition and development of the SEASAT-A Demonstration Program, leading to the implementation of a set of experiments which would begin during the latter part of 1978 following the launch of SEASAT-A (now scheduled for May 1978). NASA through the SEASAT-A program, has encouraged the planning of cooperative experiments by industry and government agencies that operate in areas of ocean activity that could benefit from improved measurements and forecasts of weather and ocean

conditions. The objectives of these experiments are to: (1) evaluate the significance of SEASAT-A data to commercial user organizations; (2) assist in identifying those characteristics of follow-on systems that are important to industrial users; (3) obtain experimental evidence that could be used to refine estimates of the economic potential of an operational system; and (4) begin the technology transfer process to the industrial users. Author

N78-21991*# National Aeronautics and Space Administration, Washington, D. C.

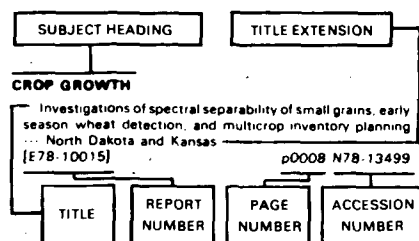
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(AN-OSTA-78-A) Avail: NTIS HC A03/MF A01 CSCL 05A

The discipline programs of the Space and Terrestrial (S&T) Applications Program are described and examples of research areas of current interest are given. Application of space techniques to improve conditions on earth are summarized. Discipline programs discussed include: resource observations; environmental observations; communications; materials processing in space; and applications systems/information systems. Format information on submission of unsolicited proposals for research related to the S&T Applications Program are given. J.M.S.

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section (of this supplement). If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

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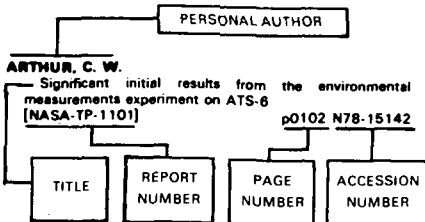
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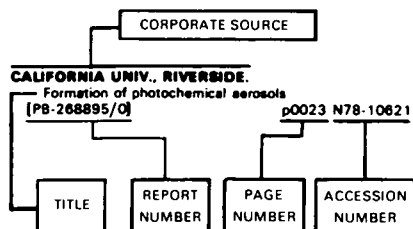
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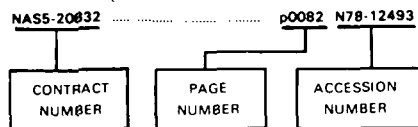
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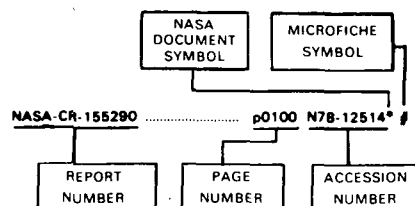
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